Policy Dimension of Chemical and Biological Warfare with Particular Reference to India

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Certified that the thesis entitled "Policy Dimension of Chemical and biological warfare with particular reference to India" submitted by Sri Rajendra Kumar Nigam, Lecturer in Defence Studies, D.V. (P.G) College, Orai, in fulfilment of the entire requirements for the Ph.D. Degree of Bundelkhand University Jhansi, embodies the record of his own investigation and labour, carried out under my supervision and guidance and that this research work has not been sofar submitted elsewhere for aforesaid degree. Sri Nigam has put all the formalties according to rules and regulations laid down in the statutes of Bundelkhand University, Jhansi.

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(RAJENDRA KUMAR NIGAM)

P R E F A C E

One of mankind's greatest achievements in the twentieth century is the ability to destroy his entire race several times over. Nuclear, Chemical and biological weapons have the power to kill millions, irrespective of age, military status or political sympathy. There are thousands of such warheads in existence today, while only a few kilograms of certain Chemical and biological agents are theoretically capable of de-populating the whole planet.

Perhaps one of the most striking aspects about the highly secretive world of current military facts and trend is that there is nonetheless an extraordinary amount of factual information available- indeed much of it released intentionally, as part of the continuing game of deterrence. Less well-known, however, are the plans and intentions of those whose job is to prepare for the eventuality of armed conflict.

What is beyond dispute is that between the super powers, of course developing nations, an apocalyptic arsenal is already filled to the brim and that, despite occasional half-hearted efforts at control, there seems to be no significant reduction in the rate of development and deployment. India's policy on disarmament,particularly

in the context of chemical and biological weapons, also has come in far much criticism. It has been misunderstood and misrepresented in various quarters.

Hence, an attempt has been made in this investigation dealing with different aspects of chemical and biological warfare, to gain clear understanding and dimension of India's policy in this very context. However, this comprehensive study consists of seven chapters and each chapter has its own individuality.

The first chapter reflects the basic concept and historical development of chemical and biological warfare.

The second chapter deals with the classification and effects of chemical and biological warfare agents on the basis of physiological effect.

The third chapter discribes the application of chemical and biological warheads, involving their means of delivery and tactical employment.

The fourth chapter embodies the prevention and defence against chemical and biological warfare, which includes physical protection, medical prophylaxis, detection and warning and decontamination.

The fifth chapter elaborates the international

in the context of chemical and biological weapons, also has come in far much criticism. It has been misunderstood and misrepresented in various quarters.

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The fourth chapter embodies the prevention and defence against chemical and biological warfare, which includes physical protection, medical prophylaxis, detection and warning and decontamination.

The fifth chapter elaborates the international

policy regarding chemical and biological weapons, since Hague peace conference to up till now.

The sixth chapter highlights on the India's policy, which includes general policy as well as policy on chemical and biological warfare.

The seventh, concluding chapter presents a brief perview of the study to come to the conclusion.

During the research, every due care has been taken to fulfil each aspect of chemical and biological warfare in view of the India's policy. The author would like to apologize for any omission which might occured to non-availability of literature on the subject.

The research work presented in the thesis has been carried out at centre, Defence Studies Deptt., Atarra (P.G) College, Atarra, approved by the university under the supervision and guidance Lt. Dr. G.S. Niranjan, Coy.Comdr. 4/58 U.P. Bn. N.C.C., Orai.

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C O N T E N T S

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CHAPTER - I

I N T R O D U C T I O N

- Chemical and biological warfare.

- History and developments.

CHEMICAL AND BIOLOGICAL WARFARE

Modern war has assumed greater potentialities of strike and destruction in the shape of deadly warheads, designed and developed to be extensively used against the hostile countries. These warheads also include untradetional items such as chemical and biological weapons, which exclusively aim at the most vital areas of human existence.

The idea of chemical or biological attack in whatever theatre of war frightens us all. We all know that deployment of these so-called 'special' weapons on a grand scale would have consequences beyond calculations. Everybody agrees that chemical and biological weapons are abominable: The very idea of facing an attack by gas or microbes is inconceivable. In spite of the impending danger, both East and West are striving to increase enormous stocks of these weapons which can bring total annihilation of human race from the lovely planet the earth.

Chemical weapons have been defined by the United Nations as: 'Substances, whether gaseous, liquid or solid, which could be used because of their direct toxic effect against people, animals and plants', and bacterial agents of War have been defined as 'living organisms, whatever their nature, or infectious substances derived from these

organisms, intended to provoke death or disease in people animals or plants, the effects of which are a function of their ability to multiply in the person, animal or plant under attack.

The concept of the chemical and biological warfare is not new for the world. Chemistry and biology have affected the military science throughout the recorded history. Kautilya in his 'Arthshastra' had dealt with the subject in separate chapter 'PARGHAT-PRAYOG'.[1] It is evident from the historical facts that the use of such weapons has a tremendous role in war.

Modern chemical warfare represents essentially the application of chemical energy in military action, in contrast to physical energy as represented by the impact of bullets or the shock of explosives. Those that react directly on the human body are called war gases. A second group of agent are smokes that are useful in obscuring the vision of the enemy. Incendiaries or fire-producers comprise a third group.

In each case the desired effect is achieved by chemical reactions that take place after the appropriate agent has been released to atmospheric conditions. It is to be noted that these reactions are not necessarily instantaneous, as is the case when fire-arms or explosives

are employed, chemical warfare agents may act slowly and continue to be effective for extended periods of time.

Thus chemical warfare deals with the direct application of chemicals as a weapon. It is concerned with the chemical not as an explosive agent to propel a bullet or fragment of metal, but as the active agent itself to cause casual-ties by irritation, burning or asphyxiation, to make ground untenable, to screen operations or lessen the enemy's fire-power by creating a smoke screen, and to damage enemy material or personnel in incendiary effect or otherwise.

Chemical warfare is no longer a method of inflicting casualties upon an enemy. The degree to which nearly all military forces are now able to call upon in-the-field defensive measures ranging from protective clothing to hard shelters means that a chemical attack will have few opportunities of inflicting significant numbers of casual-ties once the initial suprise has been lost. Instead, the introduction of chemical warfare can act as a disabling measure that reduces the fighting efficiency of an enemy.[2]

Whereas, the biological warfare is the intentional use of agents for the purpose of producing disease or death in men, animal or crops, and defense against the use of these materials for such purposes. It is essentially public

health and preventive medicine in reverse and, except for novel means of deliberately disseminating pathogenic micro-organisms, is a form of warfare which nature has waged against man for thousands of years and against which man's modern health practices have produced effective defence.

Unlike the nuclear, chemical or incendiary weapons which can be used fruitfully for peaceful purposes, the biological weapons are unique in the sense that they have no peace-time applications. They are the only weapons that have been invented with the single idea of human destruction, they can not do any harm to inanimate objects like buildings and factories etc.

Biological warfare often referred to as germ warfare, bacteriological warfare viz BW-represents an attempt by man to examine and control the forces of nature for military use. The weapons of biological variety are different from other kinds of weapons in the sense that their results are generally delayed over a longer period of time, and it is difficult to determine whether an outbreak of disease among, men, animals or plants is the work of nature or of man. For this reason, one can not say with certainty that a nation has resorted to biological warfare unless documentary or material proof of such use can be obtained, and, because of its very nature, material proof is hard to establish.

Being living organisms these microbiological agents can reproduce and therefore spread from one individual to over millions both in time and space. Their rate of reproduction is also fantastically high, but their symptoms are not highly specific and can be detected late only during incubation period such infections become hard to control even during peace-time.[3] Biological warfare has two main divisions. The first includes attacks with "living agents" different kinds of small living things which may cause sickness or disease in people, animals or plants; the first group includes disease-bearing or plant killing insects, bacteria, viruses and fungi. The second type comprises attacks with special kinds of chemicals known as hormones i.e. "growth regulators", the best known are those used to kill weeds and other unwanted plants.[4]

Opinions of different scholars regarding the use of biological warfare as an absolute weapon differ. Some observers have described it as an absolute weapon capable of disabling or destroying the entire population of large cities directly or by the initiation of self-perpetuating disease epidemics. Other persons have rejected this view and insisted that it is not even a practical weapon and presents no danger. The truth, perhaps lies between these two extremes. Biological warfare has, in fact, a limited power of destruction.

HISTORY AND DEVELOPMENTS

From the very dawn of human civilization, people have witnessed deeper links between science and chemical and biological warfare. It is really unfortunate to obser-ve that the greatest advance in the field of science has repeatedly been towards destruction. Calculated efforts on the part of different nations to strengthen their security have resulted in the invention of enormous fatal weapons and new war-tactics.

The application of chemical and biological warfare really began before recorded history with the use of fire, smoke, noxious gases and microbes to overcome an opponent. Ancient literature of India reveals that different types of unimaginable weapons were used in wars during vedic, Upnishad, Ramayan and Mahabharat periods such as fire-producing arrows, shakti, unnatural heavy rains alongwith thunder, lightening and creating high velocity winds.[5] Similarly, the chemical and biological warfare methods used at present were also known during that period.

The use of irritant and poisonous substances to diminish the resistence of an opponent is probably as old as organized warfare. Thucydides described two methods of the use of burning sulphur and pitch in sieges in the Peloponnesian war, and through-out classical times and

middle ages were frequently employed, Greek-fire being a device of this kind. As war became more mobile and the range of actions increased, the opportunities for using such a weapon in its primitive form disappeared, but in 1855 Lord Dundonald proposed a scheme for burning sulphur on a large scale under favourable wind conditions in order to reduce the Malakoff work during the siege of Sebastopol. The suggestion was rejected on the ground of inhumanity.[6]

Biological operations do not, in themselves, constitute a new kind of warfare. In fact, the micro-organisms likely to be employed in such operations may have existed before the origin of mankind. The pattern of their relations to other living organisms was established long ago and many features of this pattern were observed before any knowledge of disease-causing micro-organisms existed. The deliberate employment of germs also had a history of its own. Biological warfare has been recognized since time immemorial. There are enough recorded minor instances of its use to indicate that man has long perceived its value as a weapon. Biological warfare, in a certain sense, can be considered to be aiding nature in the spread of disease and germs, and methods of accomplishing this were available long before the nature of disease and the existence of micro-organisms were known.

It is clear war and germs are no strangers to each other. Even with no help from man, germs have entered practically every major military campaign, and more than once germs rather than generals have decided the outcome of a conflict such as plague cut down the crusaders at the gates of Jerusalem, typhus riddled the Moors in spain, dysentery thinned the ranks of Napoleon's grand army as it moved towards Moscow and typhoid fever laid low more soldiers than bullet did during the Boer War.[7]

In ancient times the bodies of cholera and plague victims were dropped over the walls of beleaguered cities, left on the ground the enemy was expected to occupy or used to poison water points. From the historical angle the deliberate spreading of disease might well begin with Alexander the Great, who is known to have catapulted the bodies of dead men over the fort-walls of beseiged cities.[7A] Napoleon deliberately flooded the ground near the besieged city of Mantua, in the hope that Malaria would weaken the Italian's will to resist. The Russians are said to have used similar techniques against the swedes in the 18th century. The British used blankets infected with small-pox in an attempt to wipe-out whole tribes of North American Indians.[8]

These uses of biological warfare in its crudest forms served the purpose of weakening an enemy by decimation

of his man power through means other than actual conflict. In his second attempt to take Jerusalem (1192), Richard the lionheart found that Saladin had poisoned nearby wells and faced with an over-extended supply line, he withdrew. Louis 14th of France is said to have given a life time pension to an Italian Chemist on the condition that he would never reveal the secret of a biological weapon, he had invented and formulated. In 1347 the Mongols besieged the virtually impregnable Genoese trading fortress of caffa on the crimean peninsula.[8A] For some years, the plague had been spreading westward from central Asia and it soon began to ravage the attacker's camp. As much in desperation as anything else, the Mongols began to catapult the corpses of plague Victims over the walls and within a short time the defenders were suffering from a major epidemic. The Genoese took to their galleys and fled into the Mediterranean carrying the plague with them. By the spring of 1348, the Black-death had taken hold in Southern Europe's major ports and was spreading in land rapidly.[9]

The science of chemistry advanced rapidly during 18th and 19th centuries. The use of poisonous chemicals was first of all suggested to the British defence department in 1855, and in 1862, the use of chlorine gas was proposed in American civil war. Major discovery in first two decades of

20th century was the fixation of atmospheric nitrogen in explosives and fertilizers. It was purely a German discovery to which first rate military importance was given, not only by parent country but also by the allies. During this period Germans paid much attention to encourage researches in the field of chemical weapons.

At the outbreak of world war none of the combatant nations had made any preparation for the use of gas or were equipped with any defence against it, but after the failure of the initial German attack and the development of trench warfare, means were sought by the Germans to assist artillery preparation for an offensive against entrenched positions, in order to get back to a state of open warfare again. Proposals to use gas were made at an early date and on October 27, 1914, shrapnel containing an irritant substance (dianisidine chlorsul-phonate) were used by the Germans at Neuve Chapelle, however, without any success. They were followed by shell containing a strong lachrymator (xylyl bromide) in place of part of the charge of high explosive, which were used on the Russian front in January 1915, when the low temperature made the lachrymator ineffective.[10]

The introdution of gas as an effective weapon in modern warfare really dates from April 22, 1915,[11] when the Germans discharged chlorine from cylinders on a front of

about 4 miles in ypres. In less than 8 minutes more than 160 tons of chlorine gas was released by the Germans.[11A] The attack was a success far beyond the expectations.[12] A similar attack was made on the canadian front near Langemarck on April 24. Owing to various reasons the Germans failed to take advantage of the opportunity offered by these first attacks for a decisive stroke, and within a few days the Allied troops were equipped with a crude form of respirator and the immediate danger was over. Further, Germans abandoned the cloud gas attack, and from December 1915, their cloud attacks became more dangerous owing to the admixture of an increasing amount of phosgene with the chlorine, but of course the protection of the Allies was improving at the same time.[13]

As a weapon for use in an attack the gas shell offers great advantages over the cloud discharge, as it allows the use of a much greater variety of toxic substances and its employment is independent on the wind. In 1917, gas shells first became a serious factor in the tactical situation, as both the Allies and the Germans had provided themselves with considerable quantities as a result of their experience in 1916. The German shell contained mainly trichlormethyl chloroformate and chloropicrin, the French phosgene, or prusic acid, the British chlorpicrin or lachrymators. Gas shells were used mainly during active

operations for neutralizing the enemy's batteries, for interfering with the movements of troops, and for general harassing purposes. By firing gas shells it was always possible to compel the wearing of a respirator and, especially at night, this resulted in a considerable diminution of efficiency. Also sudden bursts of lethal shell were fired at targets known to be occupied in order to produce casualties by surprise before respirators had been adjusted. In order to achieve this it was necessary to set up suddenly a high local concentration of gas, and the most effective weapon for this purpose was the Livens projector, first used at Arras in March 1917. This was a crude form of trench mortar, firing a bomb weighing 60 lb and containing 30 lb.of phosgene.

In July 1917, the Germans began using mustard gas, which caused severe, slow-healing burns on the skin and damage to the respiratory tract. It was difficult to provide effective protection against this agent, which accounted for the majority of gas casualties. In the Somme offensive against British and French (March 1918) the Germans conducted a ten day artillery bombardment in Ypres-San Quentin area in which they used over 5 lakhs mustard gas shells. The first definite gas attack against American troops took place on the night of Feb,25, 1918 near Seicheprey. Approximately

175 projectiles containing phosgene and chloro-picrin were fired. Thus gas played an important part in this world war is shown by the fact that it accounted for some 8,00,000 casualties extended approximately to these nations: Russia 2,75,000; France 1,90,000; England 1,81,000; Germany 78,763; United States 70,552; Italy 13,300. Protection against gas started immediately after the first gas attack and has kept pace with the offensive since that time.[14]

There were a number of allegations of germ warfare during first world war. The great strides in medical knowledge of the previous fifty years enabled individual types of bacteria to be identified and isolated. The Germans were accused of having innoculated horses and mules with glanders cattle with anthrax, and Germans spies were caught on the ground of trying to spread plague bacteria in Russia in 1915 and 1916. A top secret American report describes accounts of German biological warfare sabotage as 'confirmed and undoubted:[15]

After world war first the major world powers maintained Chemical and biological warfare researches and development facilities. In 1919 the Russians and the Germans established a joint Institute of chemical warfare and carried out many experiments. In Great Britain too, anti-gas schools were established and experiments conducted secretly in

British laboratories. So far as France is concerned, Sir Henry Shuiller, Director General of Gas Warfare in France in his book "Gas and the Next war", emphasised the fact that for a gas attack to be effective.[15A] Between 1918 and the middle 1930S a limited quantity of defensive equipment for military personnel, principally protective masks were manufactured. After 1918 the use of these weapons continued virtually wherever warfare was in progress. The allies used chemical bombs during their short intervention into the Russian civil war, the French and spanish used various chemical weapons against dissident tribesmen in their North African Colonies, the Italians used chemical weapons in Ethiopia in 1935. Less well known was the use of chemical weapons by the Japanes during forays into China during 1930S.[16]

In 1935, a Japanese army major Shiro Ishii persuaded the Japanese authorities to let him set up a germ warfare research centre. Bombs were designed and tested and cultures of germs prepared and evaluated. In the same year, the Japanese military police, the Kempai, arrested five Russians 'spies' in the kwangtung region of China. All were said to be carrying glass bottles and ampoules containing biological agents- dysentery, Cholera and anthrax for sabotage missions.[17] After the war, Ishii claimed that the Russians

attacks were successful: according to the Kempai, 6,000 Japanese soldiers died of cholera in the Sanghai area, while 2000 of the army's horses were killed by anthrax.

These allegations spurred the Japanese war ministry into taking a far keener interest in biological warfare. In 1937, with his work at the Harbin military hospital yielding promising results, Ishii was given permission to build the world's first major biological warfare installation.

Throughout the world war second the allies maintained a policy of using toxic chemicals in retaliation only. Preparation for gas warfare, however, was not neglected by either side. The Germans, in particular, were well prepared at the outset of war. Their failure to employ gas can be attributed in part simply to a policy not to use it except in retaliation; in part to their awareness of allied readiness, offensively and defensively, for gas warfare, and in part to the fact that it was unnecessary, militarily, for them to use gas at the outset of the war. Later, when situations more suitable for the use of gas arose, Germany had lost aerial supremacy. But the military rewards of the surprise introduction of chemical warfare agents at some point of the conflict could have been considerable. The first days of the Normandy landings in June 1944 and the last desperate holding battle before Berlin in May 1945 were

typical examples of occasions where the use of nerve agents could have been responsible for turning the tide against the allies at critical times.[18]

During the second world war the British had tested their chemical weapons in Canada, Australia and India, in addition to the allied test sites in the United States. Although the facilities in Canada continued to be available to Porton down, another site was now needed, where weapons could be tested under tropical conditions. India, not found suitable for such tests. The British selected obanakoro in Nigeria, because within easy reach they could find both jungle and dry sandy ground.[19]

It is commonly assumed that the British never came near the manufacture of real nerve gas weapons. Yet the devices tested in Nigeria show how far advanced was their development. The weapons included 25-lb.artillery shells, 5.5 inch naval shells, mortar bombs, and small 'bomblets' for use within a larger aircraft 'cluster bombs'. All were British made.

Meanwhile at Porton down experiments were carried out on human 'guineapigs' to assess the effects of the nerve gases. By 1953 no less than 1,500 British service men had volunteered for the Porton down tests. But in May that year

one of the experiements went disastrously awry.

The British biological warfare project was launched on 12 February 1934 and Sir Maurice Hankey suggested that the possibilities and potentialities of this form of warfare must be considered and tested.[20] By late 1941 enough progress had been made to conduct an open air test on the small uninhabited Island of Gruinard off the west cost of Scotland. During field trials conducted in 1942 and 1943, defence scientists exploded small bombs containing anthrax spores. As a result, the whole 200 hectres of the Island became contaminated.[21]

During world war second, biological warfare was practised by the Japanese in China and by Partisans in Russia, Poland and Yugoslavia. Since the war there have been unsubstantiated allegations of American uses of biological weapon in Korea, Vietnam and recently in clandestine attacks on Cuba. In 1940 researchers at Britain's great chemical combine, ICI, discovered a number of substances 'showing powerful growth retarding properties'.[22]

Extensive aerial spray tests were carried out over the east of England, and eventually two chemicals were chosen as anti-crop agents code named '1313' and '1414'. After two years their merits were re-examined. In April

1944, Britain turned over all her technology to the United States. In addition to the substances already examined in the United Kingdom approximately 800 chemical substances had been examined in America. The weapons eventually produced by pooling the two countries work were code-named 'LN' -LN-8., LN-14, LN-32 and LN-33, LN-32 was the only agent produced in United Kingdom.

By the end of 1944, Germany had a formidable nerve gas arsenal dispersed around the country. Poison gas shells were stored at Krappitz in upper Silesia, others were said to have been hidden in old mine shafts in Lausitz and Saxony. In all, the various top secret munitions dumps contained around 12,000 tons of Tabun 2,000 tons were loaded into shells and 10,000 into aircraft bombs.

By 1945 the Americans also had a range of biological anti-crop agents which they were capable of mass-producing: exotic-sounding fungi like Sclerotium rolfsii (Agent-C) which rots the stems of tobacco plants, Soyabeans and Sugar beets, Sweet potatoes and cotton, Phytophtera infestans (Mort) de Bary (Agent LO) which causes 'late blight' in potatoes; Piricularia oryzae (Agent IE) a fungus which attacks rice, and Helminthosporium oryzae Van Brede de Haan (Agent E), the cause of 'seedling blight' and 'brown spot' on young rice plants.[23]

The Japanese war time programme lasted from 1936 to 1945 and involved considerable human experimentation at a special facility constructed at Harbin. The site was near a small village called Pingfan, about 40 miles south of Harbin, close to the South Manchuria rail-road. The Pingfan institute, as it was known, had a garrison of 3,000 scientists, technicians and soldiers, and was completely self-supporting. Within its closely guarded walls was a school and a hospital, and a separate compound for plague research. An attached air base provided lavish transport facilities for the senior scientists as well as air-craft for field trials. Commenting on this institute, American intelligence wrote: in addition to various offensive activities, the vaccine production capacity of the plant was of the order of twenty million doses annually.[24] In 1949 Russian investigators put the productive capacity of Pingfan at eight tons of bacteria a month.

For offensive use, Pingfan opened a pandora's box of disease: typhus, typhoid, anthrax, cholera, plague, salmonella, tetanus, botulism, brucellosis, gas gangrene, small pox, tick encephalitis, tuberculosis, tularemia and glanders. The Japanese spent seven years trying to perfect an anthrax bomb. Over 2,000 'Uji' bombs were filled with anthrax and tested experimentally. The deadliest munition developed was the 'Ha' bomb, designed to shatter into thousands of pieces

of shrapnel, spreading the anthrax spores to murderously good effect. The standard Japanese heavy bomber could carry 12 Ha bombs. In just two years, in addition to thousands of guinea pigs and mice, at least 500 sheep and 200 horses were killed in biological tests. By 1939, over 4,000 bombs had been produced.

As inevery chemical and biological warfare installation through out the world there were stringent safety precautions. All workers were a completely rubberized anti-plague suit, together with a respirator, surgical gloves and rubber boots. After every experimental trial they were required to strip completely, 'and bathe themselves in 2 percent creosol or mercuric chloride'.[25]

Nor was poison gas used during the Korean war of the early 1950S, as it was not considered an obsolete weapon on that account. Because of the giant strides made in means of delivering agents to the target, and because of the marked increase in toxicity of agents, gas was still regarded as a powerful instrument, useful particularly when material destruction is not desired or when the enemy is dug in too firmly even for nuclear weapons to dislodge him. As far as biological warfare is concerned, in March 1952, during the Korean war, the Chinese communists accused the United Nations, specially the United States of employing biological

warfare against North Korean and Chinese communist forces.

America carried out many experiments, with the result, by the mid of 1960 the American armed forces were equipped with an enormous range of weapons filled with nerve gas: artillery shells, rockets warheads, missile war-heads, and a range of bombs from small 'bomblets' to 500 pounds 'Wetey' bombs. Between 1951 and 1969, the United States army carried out at least 31 anti-crop tests, and rice and wheat blast fungi were stored at Fort Detrick and Edgwood arsenal. During Vietnam war, America used the highly controversial agent 'orange' to defoliate the jungle. Americans also used cocodylic acid on rice crops against villages deemed to support the Vietkong. Of chemical warfare, more recently unsubstantiated allegations have added the Vietnamese in combodia and Russians in Afghanistan.

By 1967, Newport factory, run for the Pentagon, had produced 4000/5000 tons of nerve agents. In 1968 the United States army carried out a series of tests and a massive flock of sheep grazing in testing field began to fall sick within hour. Like it, in summer of 1969, came a bad news, that was leakage of VX nerve agent from a container at the American base on the Japanese Island of Okinawa and 23 servicemen had been taken to hospital suffering from its effects.

In the late 1970S the United States chalked out a huge programme of modernization of the chemical-ammunition stocks of its armed forces. The starting point was a study undertaken by the Stanford research institute.[26] It is said that the United States felt the need to prepare for chemical warfare, especially in Europe, and that other potential theatres, namely the middle-east and far east, were of minor importance.[27]

Among the European allies of the United States were also to be found those who advocated a more rapid development, and the mass production, of even more dangerous types of chemical weapons. Hans Ruhle of the Federal Republic of Germany, wrote, in a paper devoted to this issue and pulished in 1978 in Europaische Wehrkunde: Since it is to be feared, however, or one has, at least, to consider the possibility of the broad public stumbling at equipping NATO forces with offensive chemical weapons, one should, on the one hand, determine the appropriate potential and, on the other, have a suitable information strategy up one's sleeve.[27A]

Later on, this strategy was practised on a large scale. Its aim is to psychologically influence people so that they become favourably disposed to the idea of using chemical weapons in war.[27B] It is full of reproaches towards the Soviet Union and other socialist countries despite the

fact that the Soviet Union has always unequivocally proved such statements to be baseless. Referring to western allegations, Major General professor Dr. A. Kuncevich declared at a press conference in Moscow: The Soviet Union neither used chemical weapons in Asia nor transferred them to any recipient whatsoever.

But the advocates of the chemical arms race are not abashed by the refutation of statements on the alleged use of so called mycotoxin agents by Vietnamese forces in South-East Asia. For many years, the accusation that the Soviet Union is 'superior' in certain areas of arms technology has been used again and again to construct and propagate new pretexts for stirring up the arms race in the field of decisive types of weapons, especially weapons of mass destruction.

Thus we see that in the world many conferences, conventions and treaties have been organized, but most of the countries are reported to be still engaged in perfecting these weapons into more mortal weapons. In January 1978, a correspondent with Reuters news agency reported from NATO head quarters that 'scientific experts' had informed him that the Russians were developing 'three horrific new diseases for warfare, Lassa fever, Ebola fever and Marburg fever.[28] Soon there was a positive cascade of stories about

Soviet preparations for germ warfare. A Polish army officer claimed to have been told that KGB specialists in biological warfare had been posted at Cuba.[29] Then in 1979 came perhaps the most sensational allegations of all.

In 1979 operations began at an industrial-sized prototype destruction facility in Utah using munitions from an adjacent army depot in order to evaluate advanced chemical technologies for nerve and mustard gases.[30] Britain, in 1980, one of the laboratories which had been transferred to the health department, after the signature of treaty was handed back to Port-Down, for use by the defence microbiologists for assesing possible new germ warfare threats.

In 1980, the British opened a purpose designed 7,000 acre chemical warfare "battle run" training area in the Wiltsher hills alongside Port-Down. The United States army proposed a specialist chemical training school in Albania. The pentagon produced a plan. A factory would be built, capable of producing 70,000 binary GB nerve agent artillery shells filled with the chemical precursors of VX nerve agent and 500 pounds 'Bigeye' bombs also filled with VX. A final stage of the plan provided for the mass production of chemical weapons for the multiple launch rockets and 'Lance' battle field missiles.[31]

The United States keeps a great stock of chemical

warfare. In Feb,1982 President Regan announced the programme of "Chemical rearmament" for the army. Even before this decision was taken, the United States was already in possession of huge stockpile of chemical weapons in the world, that could destroy all life on earth. In 1982 the United States chemical arsenal was estimated at more than 150,000 tons, including some three million artillery rounds, scores of thousands of aerial bombs, hundreds of thousands of mines and a diversity of other chemical weapons. Research and development in the field of chemical warfare upto 1987 consumed 2.5 billion dollars.[32] The United States keeps stockpiles of its chemical weapons not only within its own territory but also in Europe, Japan and on Islands in pacific.

Conducting this broad programme of "Chemical rearmament" the pentagon again tried to shift the blame on to others. The United States has accused the Soviet Union and its allies of using nerve gases and poisonous 'Yellow Rain' in Afghanistan, Combodia and Laos for several years. Since 1984, the level of activity has decreased, but the Soviet activity did degrade the norms against sue of chemical weapons.

The Soviet allegedly made a stockpile of biological weapons despite the existing ban blantantly ignoring it,

according to defectors. A 1979 outbreak of anthrax in Sverdlovsky near a plant believed to produce such weapons, as well as the 'Yellow Rain' toxin used in South-East Asia. Soviet interest in the genetic engineering of biological weapons is also alleged. "The military applications of new biotechnology developments"are being studied by the Soviets according to the pentagon's 1984 booklet on Soviet military power. The Soviets are also performing genetic engineering research with application for improving the effectiveness of disease causing biological warfare agents, it added.[33]

In November 1980, Paris-police, during their raid against terrorists of the west German red army, discovered a miniature laboratory intended to develop the culture of bacteria which causes botulism, and there have been unconfirmed reports that Palestinians have trained German terrorists in the use of bacteriological substances.[34] It has also been reported that in Iran (University crusade) 200 graduates with atleast a first degree carrying out various experiments on chemical substances as mustard gas and military equipment.[35]

NATO and United States intelligence sources have reported some 32 chemical weapon- storage sites throughout the Eastern European warsaw-pact countries. The 1985 defence white paper of the Federal Republic concluded that

the chemical weapon potential of the warsaw pact poses a serious threat to NATO, especially since these weapons are fully integrated into the planning of military-offensive operations.[37] East Germany has been producing chemical weapons at a large facility near the chemical combine at Bitterfield. A similar facility is located in Czechoslovakia.[38] Sixteen nations, eleven of the outside NATO, now have chemical weapons. New possessor is Romania.[39] That army also shared its chemical warfare expertise with Malaysian army.[40]

The pentagon is quietly increasing its research into germ warfare. It is cloning some of the world's rarest and deadliest of diseases to increase its arsenal for germ warfare. Claiming that its research is meant for defence against biological and chemical weapons that already exist in Soviet Union. For conducting the much dreaded germs-war, the United States army has today become one of the leading employers in research on germs, causing infectious and killer diseases. It is also paying huge sums to 23 universities and commercial laboratories to engineer genetically fast breeding hybrids of different virus fevers that occur in regions as far away as Saharan Africa.[41]

Like biological warfare, in the field of chemical warfare, United States airforce also planned to start

fielding in 1987 a new generation of air crew protective gear for chemical warfare. The improved equipment promises to increase the combat effectiveness and endurance of crew members by reducing the heat stress and other burdens imposed by the current generation chemical defence esemble.[42] Meanwhile, production plans and facilities for a new range of chemical munitions exist in the United States. The payload of these new-technology 'binary' shells and bombs is two chemical substances, difluoro and isopropyl alcohal amine, which while seperated are non-lethal but on being mixed form the deadly, non-persistent nerve agent GB2.[43]

The redent development of chemical and biological warfare was unusually active during 1986. Whether they are false or true, the present studies is in a position to state any thing more. As for public western commentary during 1986 on Soviet CBW employment doctrine, there was little new beyond an increased preoccupation with the possible clandestine applications of CBW weapons by Soviet Spetsnaz units.[44] The United States administration had long been maintaining that existing US stockpile of chemical weapons did not provide sufficient in-kind deterrence to a Soviet threat which it had been portraying as large growing.

Publicity continued to be given during 1986 to

reports that more and more states were moving to,acquire chemical warfare weapons. Soviet Union believes that 13-15 nations now possess these weapons. But as per table of possessors mentioned in SIPRI Year Book 1987, reveals at least 37 nations have been identified since 1980, nearly all of them on purportedly excellent authority.

The notion that chemical weapons were spreading to more and more countries continued to be expounded during 1987. The figure 20 was mentioned by British officials.[46] A number of countries prepared to develop such weapons of mass destruction, but only the United States and Soviet Union have officially admitted the existence of such weapons.

No new chemical weapons were produced during 1987 but some of the countries were alleged to have produced such weapons without having any use. As syria reported about the Iranian production efforts.[47] On 27 December,1987 head of the Iranian country declared that Iran was producing chemical weapons.[48] Libya has been the subject of discussion for about its purporated chemical warfare armament. Most prominent were the allegations during summer of Libya, having agreed to provide Iran with Soviet made sea-mines in return for Iranian manufactured chemical weapons. The literature reveals that 200 gas masks had been sent to chad by America in August 1987.[49]

In Israel the chemical warfare capabilities of Syria continued to be the subject of much parliamentary and press concern, and civil-defence exercises to protect against chemical warfare had begun to reach even into children's school.[50] Israel intelligence reports on Syria reveals that an army which is developing and stockpiling very advanced chemical agents including nerve agent munition capable of being delivered by aircraft and SCUD missiles.[51]

For those states which declare current possession of chemical weapons or future plan to possess them, the most conspicuous developments of 1987 regarding their chemical warfare armament were the following. France was probably advancing with chemical weapon rearmament programme.[52] Iraq appears to have increased its consumption of chemical weapons in Gulf-war. Iraq has been establishing indigenous production capacity for certain of intermediates as well, thus moving its overall chemical warfare agent production capability further back towards basic raw materials occur naturally in Iraq.

For the Soviet Union,1987 was distinctive as being the first time since 1938 that the existence of Soviet chemical weapons was publicly acknowledged in official statements. At the end of the year, the foreign ministry

of the Soviet Union declared that the Soviet stock of chemical weapons does not exceed 50,000 tons of chemical warfare agent in the USSR, that is, corresponding to the amount possessed by the United States.[53]

Thus we see that, inspite of protocols binding many countries, the world has witnessed many full-scale tests and acts of agression, involving the use of chemical and biological weapons.

The menace of national security which has slowed down progress on the control of chemical and biological warfare has become more evident, and the type of response that Governments can offer, has become more and more limited. Of course, the possibility of negotiated disarmament in this field is always open to Geneva, but unless the declaration of intent by certain world leaders is not translated into action soon, this possibility will disappear. In the meantime the desire to pursue unilaterally all-out military preparation for chemical and biological warfare could soon lead irreversibly to a new and preposterous arms race.

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CHAPTER - II

:: CLASSIFICATION AND EFFECTS ::

- Chemical Warfare Agents.

- Biological Warfare Agents.

CHEMICAL WARFARE AGENTS

Modern life depends on the use of chemicals. In our century great progress has been made in chemical industry, Science and medicine. Of more than 6 million known chemicals there are now 60 to 70 thousand in common use. Between 500-1000 new chemicals come on to the market each year.[1] Many of these chemicals are hazardous by their nature and great care must be taken when using them, storing them and disposing of them. Special problems arise when chemicals which have never before appeared in nature, such as chemical warfare agents, are produced in large quantities. Military research centres and other research institutions in many countries are working intensively on discovering new agents and on improving chemical weapons.

By chemical weapons, we mean those chemical agents which are based on the toxic properties of chemicals rather than on the energetics of,their interaction.

Chemical agents are inorganic substances used in warfare to attack the organs of the human body in such a way that they prevent those organs from functioning normally. The intention is either to prevent the human body from functioning at all or to somehow prevent some aspect or another of its normal processes from proceeding

normally. The results are usually disabling to a varying degree or fatal.

The chemical agents applied in war which, by ordinary and direct chemical action, produce a toxic or powerful irritant effect on human body. Solids, liquids, or true gases, may be applied as chemical warfare agents however, in their actual use in the battle area, the solid or liquid is converted by normal or artificial volatilization into a true gas or is disseminated as minute solid or liquid particles called aerosols. Irritant smokes are types of aerosols included under the term gas because their principal use is for their physiological effect.

On the basis of (i) Purpose, and (ii) Degree of toxicity, the chemical warfare agents can be classified into two following groups:[2]

(i) Single purpose agents:

Chemicals that can be used for military purposes and which do not currently possess civilian significance eg. V-Compounds (VX), Soman (GD), Sarin, Tabun (GA), S-Mustard (HD), N-Mustard (HM) etc.

Estimated toxicity values of some single-purpose agents are given below:-

NAME	LD_{50} (MG/MAN)	LCT_{50} ($MG/MIN/M^3$)	EXPOSURE LIMIT (MG/M^3)
V-Compounds(VX)	7- 14	10- 50	0.00001
Soman (GD)	700-1400	50-100	-
Sarin (GS)	1750-3500	100	0.0001
Tabun (GA)	3500-4900	400	-
S-Mustard(HD)	2800-4200	1500	0.003
N-Mustard(HM)	700-1400	-	-

(ii) Dual purpose agents:

Which can be used both for military and peaceful purposes eg. Phosgene, Hydrogen Cyanide, Cyanogen Chloride, Chlorine etc.

TOXICITY VALUES OF SOME DUAL-PURPOSE AGENTS

NAME	LCT_{50} ($MG\ MIN/M^3$)	EXPOSURE LIMIT (PPM	MG/M^3)
Phosgene	3200-3500	0.1	0.4
Hydrogen Cyanide	2000-4500	10	11
Cyanogen Chloride	7000-11000	-	-
Chlorine	19000	1.0	3.0

From the military point of view the most important classification of chemical warfare agents are in accordance with[3]

i. Physiological effect.

ii. Persistency.

iii. Tactical use.

The Physiological effect classifies the chemical according to its primary action on the human body even though it may produce other secondary effects. The severity of effect is roughly proportional to the concentration and the time of exposure. Further the classification of chemical warfare agents has been proposed as following:

i. Chocking Agents.

ii. Blister Agents.

iii. Blood Agents.

iv. Nerve Agents.

v. Vomiting Agents.

vi. Tear Agents.

vii. Incapacitating Agents.

The following description of chemical warfare agents should not be taken as complete. It contains most of the known military chemical agents but new horrors are constantly being devised in laboratories all around the world and are

cell walls heal, and the patient recovers. However respiratory problems of one form or another may remain chronic for years. The severity of poisoning can not be estimated from the immediate symptoms, since the full effect is not usually apparent until 3 or 4 hours after exposure. It is a delayed casualty agent.

Diphosgene[6], chemical name Trichloromethyl Chloroformate, as a shell filling, it has the advantage of a high boiling point which permits filling in the field. However, Diphosgene does have certain disadvantages. Since it is slightly lacrymatory, troops are not as easily surprised as with phosgene. It is converted to phosgene in the body and exerts its effect after this conversion. Since Diphosgene is converted, the physiological action is the same for both the agents.

Chlorine[7] is now of little use and is rarely encountered in a military context. Rate of hydrolysis-slow, odour-pungent and unmistakable, Like bleaching powder. It is powerful irritant, first on upper and then on lower respiratory tract. Duration of effectiveness is shorter.

ii. BLISTER AGENTS:-

These are used for casualty effect, the use of ground may be restricted, movements slowed, and use of

material or installation hampered. They attack any part of the body with which the liquid or vapour comes in contact, especially moistened parts. They are absorbed or dissolved on exterior or interior parts of the body, followed by production of inflammation, burns and destruction of tissue. There is no immediate pain and effect is delayed for some period after exposure. Protection against this class of agents is very difficult because of their insidious action. These agents affect the eyes and lungs and blister the skin. Now many blister agents have been developed which are odourless and vary in duration of effectiveness. The important agents of this class are Mustard gas, Lewisite, Phenyldichloroarsine, Methyldichloroarsine and Ethyldichloroarsine etc.

Distilled Mustard (HD)[9], chemical name-2,2' dichlorodiethyl Sulfide, it is purified by washing and vacuum distillation and odour like Garlic. Mustard acts first as a cell irritant and finally as a cell poison on all tissue surface contacted. Delayed rate of action usually 4 to 6 hours or more have been observed. The physiological action of Distilled Mustard may be classified as local and general. The local action results in conjuctivitis or inflammation of the eyes, erythema which may be followed by blistering or ulceration, and inflammation of

the nose, throat, trachea, bronchi, and lung tissue.

The Nitrogen Mustards are a group of related compounds which may be considered as derivatives of amonia because the hydrogen atoms are replaced by various organic radicals. In each of these chemical agents, Nitrogen is the central atom. A few important agents of this group are Nitrogen Mustard HN-1, HN-2 and HN-3, odour-faintly fishy or musty, delayed rate of action 12 hours or longer. Eyes are susceptible to low concentration, higher concentrations are required to produce incapacitating effects by skin absorption rather than by eye injury, effects on the respiratory tract include irritation of the nose and throat, hoarseness progressing to loss of voice, and a persistent cough. Fever, laboured respiration, and moist rates may develop. Broncho-pneumonia may appear after the first 24 hours. Ingestion or systematic absorption, causes injury to intestinal tract. Duration of effectiveness depends on the munitions used and weather.

Mustard- T Mixture (HT) is a mixture of 60 percent distilled mustard and 40 percent T.T., a sulphur and chlorine compounds. It causes blisters, irritates eyes and is toxic when inhaled. It has a longer duration of effectiveness, is more stable, and has a lower freezing point than distilled mustard.

Phosgene Oxime (CX)[10] Dichloroformoxime is a colourless, low melting point solid or as a liquid. It is a powerful irritant which produces immediate pain and violent irritation to the mucous membrane of the eyes and nose. When it comes in contact with the skin, the area becomes blanched and is surrounded by a red ring.

Lewisite (L), chemical name- Dichloroarsine, odour like Geranium, effect similar to distilled mustard but, in addition, acts as a systemic poison, causing pulmonary oedema, diarrhoea, restlessness, weakness, subnormal temperature and low blood pressure. When inhaled in high concentrations it may be fatal in as short a time as ten minutes. Duration of effectiveness is very short under humid conditions.

Mustard-Lewisite Mixture(HL) is a variable mixture of Lewisite (63%) and distilled Mustard. It causes severe damage to the eyes. Contamination of the skin is followed after a short time by reddening, then by blistering which tends to cover the entire area of the reddened skin. In the most severe cases pulmonary oedema may be accompnied by pleural effusion. Duration of effectiveness depends on the munitions used and weather.

Phenyldichloroarsine (PD) is classed here as a blister agent, it also acts as vomiting agent. Rate of

action immediate affects eyes but on skin delayed from 30 minutes to an hour. It is less effective than distilled mustard.

Ethyldichloroarsine (ED)[11] was introduced by the Germans in March 1918. Odour-fruity, but biting and irritating. Its vapour is irritating but not harmful to eyes and skin except on prolonged exposure. Liquid ED has approximately one twientieth the blistering action of liquid Lewisite.

Methyldichloroarsine (MD), as with lewisite and other similar arsenicals, MD is irritating to the respiratory tract and produces lung injury upon sufficient exposure. The vapour is irritating to the eyes and the liquid may produce severe eye injury. The absorption of either vapour or liquid through skin in sufficient amounts may lead to systemic poisoning or death. Duration of effectiveness is relatively short.

iii. BLOOD AGENTS[12]:

Blood agents directly affect the heart action or nerve reflexes, or interfere with absorption and assimilation of oxygen by the body. The agents are absorbed into the body primarily by breathing. They affect bodily functions through action on the enzyme Cytochrome-oxidase,

thus preventing the normal transfer of oxygen from the blood to body tissue.

Carbon Monoxide and Hydrocyanic acid, which pertain to this class, have never been effectively used in war because they are lighter than air and do not remain for long on a given ground area. Except these, a few important examples of this group are Cyanogen Chloride, Arsine etc.

Hydrogen Cyanide (HCN) or Hydrocyanic acid[13] is a paralysant that acts on the central nervous system to produce quick death. It has a slight odour, resembling that of bitter almonds. However, its usefulness is limited, principally due to the rapid dissepation of the agent in the field because of its high volatility. Some what better success in building up effective field concentrations may be obtained by delivering the agent to the target in gas bombs of large volume, when this is done, a phenomenon of cloud cooling occurs, permitting a nonpersistent gas cloud to remain in the target area for several minutes.

An other well known blood agent is cyanogen chloride (CK)[14]. Its rate of hydrolysis is very slow. Its irritating and lacrymatory properties are so great that the odour can go unnoticed. Too low to be of military importance in connection with the skin and eye toxicity. The general

action of Cyanogen Chloride is similar to that of hydrogen cyanide. It interferes with the utilisation of oxygen by the body tissues. However, it differs from hydrogen cyanide in that it has a chocking effect, a strong irritating effect, and causes a slow breathing rate.

Arsine(SA), chemical name- Arsenic trihydride, odour like mild garlic, rate of hydrolysis is rapid, but an equilbrium condition is reached quickly. Under certain conditions arsine forms a solid product with water which decomposes at 300°. Arsine interferes with functioning of the blood, and damages the liver and kidneys. Slight exposure causes headache and uneasiness. Increased ex-possure causes hills, nausea and vomiting. Severe exposure damages blood, causing anaemia. Duration of effectiveness is short.

iv. NERVE AGENTS[15]:

While the nerve agents differ in molecular structure, they have the same physiological action on man in that they upset the balance between sympathetic and parasympathetic nervous system which together are the autonomic nervous system. Nerve agents inhibit the normal action of the body enzyme, cholinesterase, thereby causing an accumulation of toxic amounts of acetylcholine. This leads to continual stimulation of the parasympathetic nerve

system. The vapours, when inhaled, may cause nausea, vomiting and diarrhea, these effects may be followed by muscular twitching and convulsions. Even in low concentrations the vapours cause eye pupils to contract; Vision becomes difficult and headache may result. After short exposure a sense of tightness in the chest may be noticed. Small amounts of liquid nerve gas on the skin may cause salivation and a twitching of affected area. Severe cases of nerve gas poisoning repidly result in convulsions, coma and unless promptly treated death. The most important examples are Tabun, Sarin, Soman and V-agents.

Tabun (GA), chemical name- Dimethylaminoeth-oxycyanophosphinne oxide, odour-faintly fruity non when pure, is colourless to brownish liquid giving colourless vapour.

Sarin (GB), chemical name-Methylisopropoxy-fluro-phos-phine oxide, almost no odour in pure state, very rapidly hydrolysed in alkaline solutions.

Soman(GD), chemical name-Methylpinacolyloxy-fluoro-phosphine oxide, fruity odour, with impurities,odour of camphor.

Eye and skin toxicity.

(a) Eye effect:- Very high toxicity, vapour causes pupil of eye to contract, resulting in difficulty in seeing in dim light and generally distorted vision.

(b) Skin effect:-Extremely toxic by skin absorption. Liquid does not injure the skin but penetrates it rapidly.

Individuals poisoned by these agents (GA,GB,GD) display approximately the same sequence of symptoms regardless of the route by which the poison enters the body by inhalation, absorption or ingestion. These symptoms in normal order of appearance, are running nose, tightness of chest, dimness of vision and pinpointing of the eye pupils, difficulty in breathing, drooling and excessive sweating, nausea, vomiting, cramps and involuntary defaecation and urination, twitching, jerking and staggering, and headache, confusion, drowsiness, coma and convulsion. Symptoms appear much more slowly from skin dosage than from respiratory dosages. Although skin absorption great enough to cause death may occur in 1 to 2 minutes, death may be delayed for 1 to 2 hours. Respiratory lethal dosages kill in 1 to 10 minutes, and liquid in the eye kills nearly as rapidly. Duration of effectiveness depends upon the munitions used and the weather.

V-agents[16], included in the category of nerve agents are VE, VM, VS and VX. The standard V-agent is VX, its chemical name is (O-ethyl S-(2-disopropylamino ethyl)methyl phosphonothiolate). Unlike sarin, VX is non volatile and highly persistent, normally appears as a heavy oil liquid. It is more toxic than either sarin or soman and about half miligram can be fatal when inhaled. VX may persist for weeks in cold climate but only a few days in warmer ones. The other V-agents Chemical names are :-

VE - O-ethyl S-(2-diethylaminoethyl) ethylphosphonothiolate.
VM - O-ethyl S-(2-diethylaminoethyl) methylphosphonothiolate.
VS - O-ethyl S-(2-diisopropylaminoethyl)ethylphosphonothiolate.

V-agents are generally colourless and odourless liquids which do not evaporate rapidly. They are absorbed by vegetation. In liquid or aerosol form, these agents affect the body in a manner similar to that of nerve agents. They are usually disseminated as liquid droplets which produce casualties when absorbed through the skin. Since liquid nerve agents evaporate quickly from the skin, the dosage required to produce casulties by that route is high and the time to appearance of casualties is correspondingly short as compared with the much less volatile V-agents. If evaporation is excluded, the time to appearance of casualties would be roughly similar at the same dose level

with both V-agents and nerve agents.

v. VOMITING AGENTS[17]:

The most of the vomiting agents are normally solids which, when heated, vapourise and then condense to form toxic aerosols. Under field conditions, vomiting agents cause great discomfort to their victims; when released indoors, they may cause serious illness or death. They are primarily used for mob and riot control. The three principal vomiting agents are discussed below.

Diphenylchloroarsine (DA) is an important vomiting agent. Its rate of hydrolysis slow in mass but rapid when finally divided. No pronounced odour, and rate of action is very rapid. In progressive order, irritation of the eyes and mucous membranes. Viscous discharge from the nose similar to that caused by a cold, sneezing and coughing, severe headache, acute pain and tightness in the chest, and nausea and vomiting. For moderate concentrations the effects last about 30 minutes after an individual leaves the contaminated atmosphere. At higher concentrations, the effects may last up to several hours. Duration of effectiveness is short because agent is disseminated as an aerosol.

Adamsite (DM)[18], chemical name-Diphenylaminochloroarsine. Rate of action is very high, no pronounced

odour. Its effects are same as with DA, but the effects develop more slowly. At higher concentrations, the effects may last upto 3 hours.

Diphenylcyanoarsine (DC), odour, similar to a mixture of garlic and bitter almonds. Rate of action is very rapid. Higher concentrations are intolerable in about 30 seconds. It is more toxic than DA. Rest effects are similar to DA and DM.

vi. TEAR AGENTS[19]:

They irritate the mucous membrane around the eyes, causing intense smarting and a profuse flow of tears with resultant hampering of vision. Effect from concentrations in the field is only temporary, recovery being complete with in a few minutes after removal from contaminated area. They have little more than nuissance value in war in view of the effectiveness of the modern protective respirator. The principal tear agents are discussed below.

Chloroacetophenone (CN), not readily hydrolised, odour-fragrant, similar to apple blossoms. In addition to powerful lacrymatory effects, it is an irritant to the upper respiratory passages. In higher concentrations, it is irritating to the skin and causes a burning and itching sensation, especially on moist parts of the body

and may also cause blisters.

CNC, is the solution of chloroacetophenone in chloroform. So its odour is similar to chloroform. It causes flow of tears, irritates respiratory system and cause stinging to skin.

CNS like CNC, has no chemical name. It is a mixture of chloroacetophenone, chloropicrin and chloroform, odour-like flypaper. In addition to having effects described under chloroacetophenone, it also has the effects of chloropicrin (PS) which acts as vomiting agent, a chocking and a tear agent. It may cause lung effects similar to those of phosgene and may also cause nausea, Vomiting, Colic and diarrhoea which may persist for weeks.

CNB, is the solution of chloroacetophenone in benzene and carbon tetrachloride. Odour-like benzene and duration of effectiveness is short. It was adopted in 1920 and remained in use until it was replaced by CNS.

BBC, Bromobenzylcyanide produces a burning sensation of the mucous membranes severe irritation and lacrimation of the eyes with acute pain in the forehead. It is less toxin than phosgene. Odour-like soured fruit and duration of effectiveness depends upon the weather and the munitions used. Heavily spalashed liquid persists 1 to

2 days under average weather conditions.

CS.O - Chlorobenzalmalononitrile, is a white crystalline powder which is insoluble in water but soluble in methylene chloride. Odour-pepper like, and produces immediate effects even in low concentrations. The onset of incapacitation is 20 to 60 seconds and the duration of effects is 5 to 10 minutes after the affected individual is removed to fresh air. The physiological effects include extreme burning of the eyes accompanied by copious flow of tears, coughing, difficulty in breathing, and chest tightness, involuntary closing of the eyes, stinging sensation of moist skin, running nose, dizziness or swimming of the head. Heavy concentrations will cause nausea and vomiting in addition to the above effects.

There are at least a dozen representatives of Tear Agents:

Lacrimators	Minimum concentration for tear (ml.gm/ litre)	Volatility at the temp. 20C (ml.gm/ litre)	Minimum lethal concentration (ml.gm./ litre)
1	2	3	4
1. Bromobenzyl Cyanide	0.00015	0.1300	0.35
2. Chloroacetophenone	0.0030	0.1060	0.86

1	2	3	4
3. Ethylidoacetate	0.0014	3.1000	1.50
4. Bromoacetone	0.0015	75.0000	3.20
5. Chloropicrin	0.0020	165.0000	2.00
6. Benziliodide	0.0020	0.0012	3.00
7. Ethylbromoacetate	0.0030	21.0000	2.30
8. Phenylcarbilamine Chloride	0.0030	2.1000	0.50
9. Bengylbromide	0.0040	0.0024	4.50
10. Acrolin	0.0070	20.0000	0.35
11. Bromomethylethyl-ketone	0.0126	34.0000	2.00
12. Chloroacetone	0.0180	0.1200	2.30
13. Iodoacetone	0.0012	0.0031	1.90

vii. INCAPACITATING AGENTS[20]:

Incapacitating agents are quite distinct from harassing agents, such as tear or vomiting agents where the effects are brief, true military incapacitants may be effective for several hours or even days. They are intended to incapacitate without killing except in very unusual circumstances. There are two approaches, physical or mental incapacitation, but both carry problems which have still to be solved.

For physical incapacitation, the problem has been to find agents which caused a disabling symptoms such as muscle paralysis, interference with the voluntary control of limbs, unconsciousness or loss of sight, but would be very unlikely to cause death. Those which affected neural transmissions between muscles offered the best likelihood of incapacitation but are also the most dangerous. For example, the haloalkylcarbamoxyalkyl derrivatives and quaternary quinuclidinones, have safety ratios of only 10 to 40 respectively. Others are even more dangerous, two neuromuscular inhibitors, for example, have safety factors of only 1.8 to 3.1.

Psychological incapacitants seems to offer a more fruitful approach because they have far higher safety ratios. These act on the brain provoking temporary mental aberrations. They constantly produce changes in thought, perception and mood, without causing major disturbances of the autonomic nervous system. The best known is LSD. The principal drawback of this special type of weapon is that it provokes unforeseen and uncontrollable reactions in its victim.

LSD (Lysergic acid diethylamide)[21] is the most powerful hallucinogen known, as little as 2 micrograms per kilogram of body weight can induce hallucinations and mental disorientation for 1 to 6 hours or more. The equivalent

dosage for nescaline, by contrast, is about 5 mg.per kilogram, some 2500 times the minimum LSD dose. But LSD appears to have been rejected because of comparatively high cost of large scale production and suspicion, that its use might cause long term genetic damage.

Cannabinoid agents also incapacitate through hypotensionimbalance in blood pressure that can lead to temporary unconciousness. Mescaline (3,4,5 - trimethoxy-phenethylamine) has several analogues which have been synthesized for the purpose.

BZ (3 - quidnuclidiny benzilate)[22], an extremely potent psychoactive chemical is a member of the glycolate family and belongs to a subgroup of powerful psychoactive chemicals. It is 10 times more powerful than LSD. BZ is a crystalline solid at normal temperatures and is sufficiently stable to be disseminated as a smoke from a pyrotechnic device. Symptoms of exposure to BZ may include vomiting, stupor and a lack of co-ordination and occur with in an hour or so. After this mental disorientation and hallucinations (both Audio and visual) may incapacitate the victim sometime to the point of immobility and maniacal behaviour may follow. Severe behavioural disturbances may last or reappear sporadically for the following two or three days until the drug finally

wears off.

Recent military research into incapacitating chemicals has concentrated on physiological rather than psychoactive agents such as benzilates EA-3167 and EA-3834 as potential successors to BZ. Instead of pursuing chemicals which affect the entire autonomic nervous system and carry a large risk of killing, researchers have investigated agents whose action would be specific to certain parts of the body, such as the nerve ganglia in the legs or brain. The victim would thus only be immobilized.

PERSISTENCY:

In accordance with the persistency, the chemical agents can be divided into two groups:[23]

i. Persistent agents.

ii. Non persistent agents.

The persistency of a chemical agent is determined by the length of time it will maintain an effective concentration without being renewed.

Chemicals that remain effective for longer than 10 minutes after release in the open are defined as persistent. Usually dispersed in liquid state, persistent agents contaminate the ground on which they are released

and continue to give off dangerous vapour for long periods.

Non persistent agents are those whose effectiveness in the open continues for less than 10 minutes. They vaporize rapidly, forming concentrated clouds that drift with the wind, increasing in size but becoming diluted in gas content until they finally disappear.

TACTICAL CLASSIFICATION:[24]

Tactical classification, which is influenced by the persistency, is based on the primary military objective for which any particular chemical is used in the field. War gases are thus classified as casualty or harassing agents, smokes as screening agents, and the various fire producers as incendiaries.

CHARACTERISTICS OF SOME IMPORTANT TRAINING, TOXIC & RIOT CONTROL CHEMICAL AGENTS

CLASS	COMMON & CHEMICAL NAME	PHYSICAL STATE AT 68°F & 760 mm. PRESSURE	RATE OF ACTION	PERSISTENCY	ODOUR
1	2	3	4	5	6
Choking gas	Phosgene	Colourless gas	Immediate to 3 hr.	Nonpersistent	New-mown hay, green corn
Choking gas	Diphosgene	Colourless liquid	Usually delayed 3 hr. or more	Moderately persistent	New-mown hay, green corn
Blister gas	Distilled mustard	Colourless to pale yellow liquid	Delayed usually 4 to 6 hr. but periods as late as 24 hr. or more have been observed.	Highly persistent	Garlic or horseradish
Blister gas	Nitrogen mustard	Dark liquid	Delayed 12 hr. or longer.	Persistent	Fishy or musty
Blister gas	Lewisite	Dark oily liquid	Immediate irritation, delayed blistering.	Persistent	Geranium
Nerve gas	Tabun	Colourless to brown liquid	Immediate to 15 min.	Moderately persistent to persistent	None when pure, otherwise faintly fruity.

1	2	3	4	5	6
Nerve gas	Sarin	Colourless liquid	Immediate to 15 min.	Nonpersistent to slightly persistent.	None when pure.
Nerve gas	Soman	Colourless liquid	Immediate to 15 min.	Persistent	Fruity; with impurities odour of camphor
Training agent	Chlorine	Greenish-yellow gas	Immediate	Nonpersistent	Pungent, such as bleaching powder.
Blood gas	Hydrogen cyanide	Colourless gas or liquid.	Immediate to 15 min.	Nonpersistent	Slight, resembling bitter almonds.
Blood gas	Cyanogen chloride	Colourless gas	Immediate	Nonpersistent	Irritating & lachrymatory properties conceals odours.

1	2	3	4	5	6
Blood gas	Arsine	Colourless gas	Delayed from 2 hr.to II days	Nonpersistent	Practically odourless when pure, otherwise garliclike (metallic taste)
Vomiting gas	Adamsite	Yellow to green solid	I min.	Nonpersistent	None
Tear gas	Chloracetophenone	Solid	Immediate	Nonpersistent	Apple blossoms

BIOLOGICAL WARFARE AGENTS

Compared to chemical warfare, biological warfare has a pedigree almost as long as that of warfare itself. Ever since mankind started to fight with his neighbour attempts have been made to inflict hurt on an enemy by some how introducing illness to the squable. These agents involve the use of living organisms to attack the normal functioning of the human body to render an opponent ineffective. Primitive men, even though they had no idea of what bacteria or similar organism could be often sought to harm their enemies by introducing illness.

Biological warfare agents differ markebly from chemical warfare agents in that a living micro-organism will multiply a million fold in its life cycle so that an infinitesimal dose is enough to build up a dangerous infection in the human body. Once infection has started, there will be an incubation period of days or even weeks, according to the agent, before disease breakout. Since there is a certain time required before the symptoms of disease show up in a man, the agents could travel from a country to other countries, hidden inside the bodies of travellers.

It should not be forgotten that biological warfare agents can be utilized on animals and plants as well as

human beings. Disease such as swine fever can decimate animal herds, and populations dependent on a staple crop such as rice or maiz could be rendered helpless by the introduction of previously unknown specific plant disease. Insects such as the colorado beetle can destroy potato crops almost overnight and locusts can still reduce whole areas to virtual deserts within hours.

Toxins are also included in this section. These are extracted and purified from biological entities but are themselves not living and, in some cases, may be duplicated synthetically in the laboratory. These include the deadliest organic materials known and are known as biotoxins or often just toxins. The number of substances in this category are legion and many are well known.

It should also be kept in mind that biological warfare agent is an uncertain weapon. It takes time to take effect, is not always 100 percent effective and has a nasty tendency to be harmful to perpetrators as well as victim.

There are fine primary groups of micro-organisms from among which a biological warfare agent is likely to be drawn.

i. Rickettsiae.

ii. Bacteria.

iii. Viruses.

iv. Fungi.

And Toxins.

i. RICKETTSIAE:[25]

Rickettsiae are minute bacterium like micro-organisms visible with the light microscope. Like the viruses they are obligate intracellular, multiplying in living cells. These are primarily intestinal parasites of blood sucking arthropods such as lice, ratfleas, mites and ticks. These are the vectors that spread the disease to man. The disease caused by the rickettsiae are known as rickettsioses. Pathogenic rickettsiae invade different species of animals and men.

Rickettsia Prowazeki, the disease caused by it, is known as classic epidemic typhus. It is an acute infectious disease of man, characterised by severe headache, sustained high fever, general pains and a skin rash. Incubation is from 6 to 15 days averaging 12 days. Epidemics usually occur in winter under crowded and unsanitary conditions, particularly during famine and war, and when the population is heavily infested with body lice. The transmission is mainly by body lice which have fed upon infected persons.

Rickettsia Typhi[26], is an other agent of this group, which causes disease named murine typhus. It

is very much similar to classic epidemic typhus except that the disease is milder and has a slower onset. The disease is transmitted from rodents to man by the bite of the rat flea. The incubation period ranges from 6 to 14 days mostly 12 days, susceptibility is general. One attack confers immunity, which sometimes is not permanent.

Rickettsia Tsutsugamushi[27] causes scrub typhus, which is an acute infection in man, is characterised by sudden onset with chills and fever and headache which may increase in intensity. A dull red eruption appears on the trunk of the body on the 5th to 8th day, and may extend to the arms and legs. Coughing and other signs of pneumonia are frequently present. Transmission to man is made by the bite of infected larval mites.

Rickettsia Rickettsii[28], causes Rocky Mountain spotted fever, it is an acute infectious disease characterised by fever and joint and muscular pains. The distinctive feature that distinguishes this fever from many other diseases is a measles-like rash on the palms of the hands and the soles of the feet. A skin rash usually appears on the 3rd or 4th day, rapidly spreading from the ankles and wrists to the legs, arms, and chest. The disease is transmitted by the bite of an infected tick, by contamination of abraded skin with infected tick tissues or faeces or by contact of tick tissues with unbroken skin.

The incubation period is from 3 to 10 days.

Coxiella Burneti, is a bacterium like gram-negative organism which causes fever, characterised by an acute fever of sudden onset, headache, chills, weakness and severe perspiration. Pulmonary involvement occurs in the majority of cases, accompanied by mild cough, scanty expectoration, and chest pain. As a biological warfare agent, Q fever is comparatively stable and extremely infectious with one micro-organism being capable of producing symptoms. Cows, sheep, goats, ticks and wild animals appear to be natural reservoirs. In man the disease is transmitted by the inhalation of infected dust as well as by ingestion. Raw milk from cows and goats, dried milk, raw wool, hides infected meat as well as culture of infected tissues, have been involved in infections. The incubation period is from 14 to 26 days.

Rickettsia Akrai, is responsible for rickettsialpox, which is a general infectious disease with an incubation period of 10 to 12 days. Its characteristic features are fever and an abundant vesiculo-papular rash resembling that in chickenpox, appears on the 3rd or 4th day of the disease. Rickettsia are revealed in patient's blood during febrile period. They are intracellular and extracellular parasites and multiply readily in the lungs

of white mice during intranasal infection. House mice and grey mice and grey rats are the reservoir of the infection. The vectors are capable of transovarial transmission and as a result of it they are also the reservoirs of the infection in nature.

ii. BACTERIA:[29]

Bacteria are unicellular organisms which lack chlorophyl. Because of their biological properties and methods of reproduction, predominantly by binary fission they belong to the class schizomycetes, order-Eubacterials. The shape as well as the dimensions of microbes is not absolutely constant. Morphological differences are found in many bacterial species.

Bacteria are living cells that have to maintain life. Many can do so in an external environment such as soil. Others prefer the living body of animals or man. But a parasite does not necessarily cause disease. A few invade the tissues, and compete with the host for nourishment with resulting injury to structure and function. The bacteria which produces disease are called pathogenic bacteria. Some of them are described under:

Bacillus Anthracis is a rod shaped, gram positive, aerobic sporulating micro-organism, the spores

constituting the usual infective form. The spores are very stable and may remain alive for many years in soil and water. They will resist sunlight for several days. Steam under pressure or exposure to dry heat above 159°C for an hour are necessary to kill spores.

Anthrax[30] is principally a disease of herbivorous animals (cattle, sheep, horses and mules). In animals, anthrax occurs as an acute febrile septicaemic infection characterised by depression, weakness, difficult breathing, bloody diarrhoea and swellings in the neck, chest, flank and lumbar regions. The spleen becomes enlarged and liver damage. Contaminated soil,food,water and dust are sources of infection.

Anthrax may appear in three forms in man, cutaneous, pulmonary and intestinal. The cutaneous or skin form is also referred to as malignant pustule, occurring most frequently upon the hands and forearms of persons working with infected livestock, and is characterised by carbuncles and swelling at the site of infection. The pulmonary form is an infection of the lungs contracted by the inhalation of the spores, it occurs mainly among workers handling infected hides, wool and furs. The intestinal form, which is rare in man is contracted by the ingestion of insufficiently cooked meat from infected

animals. Cattle, sheep and horses are the chief animal hosts. Transmission is made through scratches or abrassions of the skin, wounds, inhalation of spores or by flies. Incubation is from 1 to 7 days. It is usually less than 4 days and may be less than 24 hours in pulmonary cases. The disease is not epidemic in man.

Brucella Group[31], in this group are included three closely related organisms, Brucella melitensis, Brucella abortus, and Brucella suis. All are non-motile, non-sporulating, gram negative, rod shaped bacilli. The disease produced by this group is known as Brucellosis. In man, it is characterised by irregular prolonged fever, profuse sweating, chills, pain in joints and muscles and fatigue. Brucella abortus is a parasite of milk Cows, producing contagious abortion in cattle, the organism has also been reported in mares, sheep, rabits, and guinea pigs. Brucella melitensis is primarily a strict parasite of goats and sheep, Brucella suis is a parasite of swine. These diseases are transmitted to man by the ingestion of contaminated milk and other dairy products, pickled meats, and uncooked foods and water contaminated by the excretion of infected animals and by direct contact with infected animals or animal products. Infection has also occurred by inhalation and by accidental inoculation among laboratory workers. Incubation is from 6 to 60 days or more, averaging 14 days.

As far as in animals, are concerned, Brucella abortus is the most common cause of this disease. It is mainly a disease of bovine animals. The disease may exist and persist in the genital system of the bull without evident symptoms. In pregnant cows it is characterised by a chronic inflammation of the uterus followed by abortion, results in injury to the uterus that may affect future pregnancies. Brucella melitensis produces Malta fever and contagious abortion in animals. Inflammation of the udder may be present in severe cases, but it is not until late in the disease that the milk undergoes any noticiable change or milk secretion diminishes. Brucella suis causes brucellosis of swin. As with the other forms, it can result in contagious abortion, although this does not always result, that is, abortion is not the disease but rather a symptom that is sometimes observed.

Malleomyces Mallei, is a slender, non-motile, non-sporulating, gram-negative aerobic, rod shaped bacterium. It is pathogenic for both man and animals. Glanders, an infection occasionally communicated to man, is characterised by nodular, ulcerative lesions of the skin, mucous membranes and viscera. It is an acute or chronic disease mainly of horses, mules and asses, communicable to dogs, goats and sheep. The acute form is limited to the nasal mucosa and upper respiratory tract, the chronic form, called Farcy,

is characterised by farcy buds, ulcers, and pus-forming lesions in the joints and muscles. Infected horses, mules and asses are the sources of infection. Tramission is usually made by droplet infection (inhalation) or through breaks in the skin, it is sometime made through the gastro-intestinal tract. Incubation is from 3 to 5 days.

Malleomyces Pseudomallei[32] causes melioidosis, also known as whitmore's disease is a glanders-like disease primarily of rodents but occasionally found in man. It tends to run a more rapid course than glanders does and in man is almost always acute and rapidly fatal, death occurring usually in 3 to 4 weeks, often with in 10 days. The disease is characterised by sudden onset with severe chills, high fever rapid prostration, headache, muscle and joint pains, cough, laboured breathing, nausea and vomiting. Probable sources of infection are food or other materials contaminated with rodent excreta and possibly rat fleas. Transmission takes place apparent by the ingestion of food contaminated with excreta from infected rats and by rat flea bites. Although not accurately known, the incubation period is probably only a few days.

Salmonella Typhosa, bacterium causes typhoid fever, which is a systematic infection characterised by continued fever, lymphoid tissue involvement, ulceration

of the intestines, enlargement of the spleen, rose-coloured spots on the skin, diarrhoea and constitutional disturbances. The faeces and urine of infected individuals and carriers are sources of infection. Transfer of organisms is made through the alimentary tract by direct or indirect contact with a typhoid patient or a chronic carrier by consumption of contaminated water food, milk or shellfish, and by flies. Incubation is from 3 to 38 days, usually 7 to 14 days.

Salmonella Paratyphi and Salmonella Schottmuelleri, S. Paratyphi is responsible for paratyphoid fever which is very similar to typhoid fever, but its symptoms are usually milder. It is characterised by continued fever, severe diarrhoea, and abdominal pain, with involvement of the lymphoid tissues of the intestines, enlargement of the spleen and sometimes rose coloured spots on the trunk. S.schottmuelleri is responsible for more cases of the disease and may produce gastro-enteritis. The contaminated faeces and urine of patients and carriers are the sources of infection. Transfer of organisms is the same as far typhoid. Incubation is variable from 1 to 10 days depending on strain of organism but averaging less than a week.

Salmonella Typhimurium causes gastro-

enteritis in man. The onset of the infection is nearly always sudden, characterised by headache, chills, and usually by abdominal pains. This is followed by nausea, vomiting, severe diarrhoea with a rise in temperature and prostration. The sources of infection are usually rodents, especially rats and mice, human carriers who handle food, eggs and meat from diseased animals. The disease is usually obtained by the ingestion of contaminated food, water or milk. Food poisoning occurs after an incubation period ranging from 6 to 24 hours but seldom after more than 48 hours.

Mycobacterium Tuberculosis[33], Pulmonary tuberculosis caused by this bacterium is characterised by severe lung involvement accompanied by coughing, fever, fatigue, and loss of weight. The primary type is acute, healing or progressing in a relatively short time, and is most commonly seen in infants and children and occasionally in adults who have escaped childhood infection. Susceptibility to the disease is dependent upon age, race, family characteristics, and previous exposure to the organism. Tuberculosis infection in the bones, joints, skin, or other tissues is usually caused by the bovine variety of this organism, although this type may also invade the lungs. Infection is acquired from persons with draining lung cavities. Tuberculous cattle, and particularly

their raw milk, is the source of the bovine variety. The transmission usually occurs through the discharges of the respiratory tract, by direct or indirect personal contact. Natural infection usually requires continued and intimate exposure. The period is variable, depending on dosage, age, and other factors, but probably is not less than one month. The period may be reduced considerably by exposure to heavy concentrations of the organism.

Shigella Dysenteriae[34], Bacillary dysentery is caused by this bacterium, is an infectious disease of man. It is characterised by mild or severe irritation of the lower gastro-intestinal tract accompanied by fever, abdominal pain, diarrhoea, weakness or prostration, and ulceration of the mucous membranes of the intestine. Faeces of infected human patients and carriers are the sources of infection. Transmission is made by the ingestion of contaminated food, water, or milk, by hand-to-mouth transfer of contaminated material soiled with faeces of a patient or carrier; or by flies. Incubation is from 1 to 7 days, usually less than 4 days.

Vibrio Comma[35], is responsible for !Cholera, an acute infectious gastro-intestinal disease of man, characterised by sudden onset with nausea, vomiting, profuse watery diarrhoea with 'rice water' appearance, the rapid

loss of body fluids, toxemia, and frequent collapse. Epidemicity is very high under unsanitary conditions, especially those concerned with water supplies, foods and fly control. Faeces and vomitus of patients, faeces of convalescents, and temporary carriers are the sources of infection. Transmission is made through direct or indirect faecal contamination of water or food, by soiled hands or utensils, or by flies. Incubation is from 1 to 5 days, usually 3 days.

Corynebacterium Diptheriae, Diptheria caused by this bacterium, an acute febrile disease, is generally characterised by local infection, usually involving the air passages. The systemic manifestations are due to absorption of the soluble toxin into the blood stream. The bacteria multiply rapidly in the tonsils, nose and throat, causing sore throat swelling and stopage of air passages. During the first few days of infection, is only slight fever, and there are no severe constitutional symptoms. This lack of obvious symptoms is a characterisitic of diptheria in the adult and is especially dangerous when infection occurs in the nasal passages, because the infection is not recognised or treatment is not begun until sufficient exotoxin has been absorbed to cause irreparable damage to other parts of the body. Discharges from the nose and throat of infected persons and healthy carriers or from skin lesions are

sources of infection. The disease is contracted by direct contact with patients or carriers, by droplet infection, or through articles freshly contaminated with nose and throat discharges of infected individuals. The incubation period is usually from 2 to 5 days.

Pasteurella Tularensis[36], disease caused by this bacterium, Tularemia also known as Rabbit Fever and Deer Fly fever. It is a fatal septicemic disease of wild rodents, accidentally communicable to man, in whom it is characterised by sudden onset with chills, fever, and prostration and by a tendency to pneumonic complications. In man it is an acute, severe, weakening disease, later becoming chronic, and may be accompnied by enlargement of the regional lymph glands with or without a lesion at the site of infection. Wild rabbit or hares, dear flies, ticks, and many other animals are sources of infection. Transmission is made by infection through the skin, eyes or lungs from handling infected animals, as skinning or dressing the animals or performing autopsies, by bites of infected flies and ticks, by eating in-sufficiently cooked rabbit meat, or by drinking contaminated water. Laboratory infections are not infrequent. Incubation is from 1 to 10 days usually about 3 days. The disease is essentially sporadic, but may be epidemic when modes of transmission

are prevalent. It is not transmitted directly from man to man.

Pasteurella Pestis, a bacterium is responsible for plague or black death, occurs as three clinical types in man, bubonic, pneumonic and septicemic. Another type of plague, sylvatic plague, is an infectious disease of wild rodents. In general, plague is characterised by a rapid clinical course with high fever, extreme weakness, glandular swelling, pneumonia, and/or haemorrhages in the skin and mucous membranes. Infected rodents and human patients with pneumonic plague are sources of infection. The primary source of the disease is plague of wild rodents, including the ground squirrel pack rats and harvest mice of the United States, and various species of wild rodents in other parts of the world. Infection may reach man from these sources of more often through the medium of the domestic rat. Pneumonic plague is usually transmitted directly from man to man by droplet infection. Bubonic plague is generally transmitted to man by the bites of fleas from infected rats and other rodents. Incubation is from 1 to 7 days for pneumonic plague, 4 to 7 days for bubonic plague.

iii. VIRUSES:[37]

The name virus was given by L.Pasteur to many

causative agents of infectious disease. Viruses do not have a cellular structure and are small in size varying over a wide range from 10 to 350 mu. They live and multiply in the cells of live organisms but are also able to develop in homogenates of different organs. Many species of viruses are pathogenic for man also and cause number of diseases. Viral disease make up almost three fourth of all human infectious diseases. Many species of Virus are supposed to be the highly efficient biological warfare weapons.

Foot and Mouth disease virus, is a very small virus causes Aphthous fever, which is an acute, contagious, highly infectious, febrile disease of cloven-footed animals. Man is only slightly susceptible and, if infected, shows only mild symptoms. The disease causes a marked and rapid weight loss, a rapid decrease in milk flow, and a severely lowered reproductive capacity. It is characterised by an acute fever and by vesicle formation on the feet and mucous surfaces of the mouth and cheeks and on the udder. Infected animals and contaminated food, water, milk and pastures are the sources of infection. Transmission is by the ingestion of food, water and milk contaminated with urine, saliva, vesicular fluid, faeces and by direct contact. The disease has very high communicability. It tends to spread rapidly over a wide geographic area. Incubation is usually from 24

hours to 7 days, occasionally 2 or 3 weeks.

Rinderpest Virus[38], is responsible for cattle plague. It is an acute, febrile, highly contagious and highly fatal disease of bovine animals, sheep, goats, and water buffaloes. It is characterised by sudden onset, croupous inflammation of the digestive tract, inflammation and erosion of the mucous membrances of the mouth , and bloody diarrhoea. Infected animals are the sources of infection. Transmission is by ingestion of food and water contaminated with the urine, faeces, saliva and eye and nasal secretions and by direct contact. Incubation is from 3 to 9 days. Epidemicity is very high in non-immunised animals, as the disease is highly infective.

Rift Valley fever virus, it is a highly infective and fatal disease of sheep, goats and cattle are sometimes affected, and the disease is easily transmitted to man, in whom it usually takes a mild form. In sheep, the infection is characterised by a rapid course, high fever, loss of appetite; it may produce abortion in pregnant females. Infected animals are the sources of infection. The disease is transmitted by the bites of mosquitoes and possibly by the inhalation of infected food. Incubation is from 1 to 4 days for adult animals, 12 to 24 hours for lambs.

Vesicular Stomatitis Virus[39], Vesicular stomatitis also known as mouth thrush, is a contagious, weakning, febrile disease, primarily of horses and mules and occasionally of cattle and swine. It is characterised by vesicular eruptions of the mucous membranes, particularly of the mouth. Occasionally, lesions may be found on the feet and udders. Transmission is by ingestion of contaminated food and water and by direct contact. Horses, mules and cattle infected with the disease are sources of infection. Incubation is from 2 to 9 days.

Vesicular Exanthema Virus. Vesicular Exanthema is a contagious, febrile, weakening disease of swine. It is characterised by the formation of vesicles or lesions in the mouth and nostrils, on the snout, feet and udders, and around the coronary band. Animals become lame and hoofs are sometimes shed. Transmission is by direct contact, by the ingestion of contaminated food and water, and by persons going from farm to farm. The incubation period is from 2 to 7 days.

Hog Cholera Virus[40]. Hog Cholera, also known as swine fever, is a highly acute, contagious, febrile disease of swine. It is usually chronic in order swine. It is characterised by high fever, yellowish discharges from the eyes, diarrhoea, loss of appetite, Viremia and extreme

weakness. Transmission is by contaminated garbage and through food, water, hog wallows and pens that have been contaminated from eye and nasal secretions, urine, blood and faeces of infected swine. Aerosol transmission is possible. Incubation is from 5 to 6 days.

African Swine fever virus. African swine fever also know as wart Hog disease, is a highly contagious and excessively acute disease of domestic swine. It is characterised by fever, pronounced haemorrhages of the lymphatic glands, the kidneys, and the mucosa of the alimentary tract, and by marked cyanosis of areas on the skin. It is mechanically spread by caretakers and other who pass from infected premises without taking proper precautionary measures. The incubation period is usually 4 to 7 days when exposure is made by contact with infected pigs. In epidemics the disease may occur in cent percent of susceptible domestic swine. At present there is no effective treatment for the disease.

Fowl plague virus, Fowl plague also known as fowl pest, is an acute, contagious, highly fatal disease of fowl, characterised by haemorrhages in various tissues of the body, swelling and blood poisoning. Transmission is by the ingestion of food, water and soil contaminated by the blood, urine, faeces and eye and nasal secretions from

infected fowl or birds, by infection through wounds, and possibly by blood sucking insects. Once the disease is introduced into a flock, it tends to spread rapidly and kills all or nearly all the flock in a short period of time. Infected fowl are sources of infection. Incubation is from 2 to 7 days, it may be as short as 24 hours.

New castle disease virus[41]. New castle disease, is an acute, highly contagious, febrile disease of fowl. The course of the disease is of short duration. It is characterised by severe respiratory and nervous symptoms, including difficult breathing, depression and stupor, twitching of the head and neck, marked weakness and perhaps paralysis. Infected fowl are sources of infection. Transmission is by direct contact, by the ingestion of food and water contaminated with faeces, and by the inhalation of contaminated dust. Incubation is usually 4 to 8 days, although it may be upto 13 days. No treatment has been developed so far.

Equine Encephalomyelitis Viruses. There are several viruses, each specific for the different forms of the disease. This disease is an acute infectious disease of the central nervous system of horses and mules and also of man. It is characterised by fever, drowsiness or restlessness, poor co-ordination, and occasionally convulsions,

in the severe cases motor and sensory paralysis cause prostration, and death results from respiratory and cardiac failure. Birds, and probably many wild and domestic animals, may become infected and serve as temporary reservoirs for the virus. The infection is transmitted by blood-sucking arthropods (usually mosquitoes) and perhaps by ticks, from the animal reservoirs to horses, mules and man. The disease tends to spread rapidly over local areas when insect vectors are present. The incubation period is variable, ranging from 2 to 15 days.

Psittacosis Virus[42]. Psittacosis also called parrot fever, is a severe febrile disease in man. It is characterised by acute pulmonary infection. Chills, fever, anorexia, sore throat, severe headache, backache, constipation, great weakness, and prostration and is sometimes accompnied by delirium. Parrots, parakeets, budgerigars, canaries, pigeons, and other birds are sources of infection. The respiratory tract is the principal entry path. Transmission is made by contact with infected birds or by breathing air contaminated by faeces, urine, nasal discharges or the soiled feathers of sick, dying, or latently infected birds. Apparently well birds (carrier) can transmit the infection and in rare instances man has become a carrier. Incubation is usually 6 to 15 days.

Influenza virus[43], Influenza is an epidemic disease, which is characterised by catarrhal inflammation of the respiratory tract, sudden onset, fever of 1 to 7 days duration, marked prostration, and generalised aches and backache. Sore throat, bronchitis, and pneumonia are complications of secondary infections. Soiled articles and discharges from the mouth and nose of infected persons are the main sources of infection. Transmission is probably by direct contact, by droplet infection, or by articles freshly contaminated with nose and throat discharges of infected individuals. The incubation is from 1 to 2 days.

Variola Virus[44]. Causes smallpox, a highly contagious and often fatal disease, is characterised by severe fever and small blisters of the skin. The blisters later contain pus and form crusts which fall off in 10 to 40 days after the first lesions have appeared, leaving pink scars which gradually fade. Complications of the disease are secondary bacterial infections. Lesions of the mucous membranes and skin of infected persons are the sources of infection. Transmission is made through contact with patients having the disease or with articles or persons freshly contaminated by discharges from lesions and skin of infected individuals.

Yellow fever Virus[45]. Yellow fever is a

highly infectious disease and is characterised by sudden onset, chills and fever, prostration, headache, backache, muscular pain, congestion of mucous membranes, jaundice from liver damage. Actually, it is primarily a disease of monkeys and other jungle animals, but it is readily transmitted to man. The blood from people and monkeys infected with yellow fever is the source of infection. Transmission is usually by the bite of the female aedes aegypti masquito. Incubation is from 3 to 6 days, rarely longer.

Dengue fever virus. Dengue fever, an acute, extremely disabling disease usually of sudden onset, is characterised by fever, chilliness, intense headache, backache, pain behind the eyes, joint and muscle pains, weakness and prostration, and an irregular rash. Dengue fever is said to be temporarily the most incapacitating although the least fatal of epidemic disease. Sources of infection are the blood of infected persons one day before and up to 5 days following onset, infected mosquitoes, and in some regions possibly the blood of infected monkeys. The disease is transmitted by the bite of the Aedes aegypti mosquito which has become infected by biting a patient.

Hapatitis Viruses[46]. There are two strains of Hepatitis virus, virus A or infectious hepatitis and Virus B or serum hepatitis. These both hepatitis are

characterised first by fever, loss of appetite, nausea, fatigue, headache, and abdominal discomfort. After a few days the fever subsides, then because of liver damage, bile may be present in the urine and jaundice appears. Sources of infection of virus A are discharges from the nose, mouth, and gastro intestinal tract of infected persons. Sources of infection of virus B are blood, serum or plasma from infected persons. The usual mode of transmission for virus A is unknown but virus B is transmitted by transfusions of infected blood, serum or plasma. The sharing of infected medical instruments such as by drug addicts, is a common cause of transmission. Incubation is long and variable- 15 to 40 days for Virus A, 40 to 150 days for Virus B.

iv. FUNGI:

Fungi are plants that lack chlorophyll and can not conduct photosynthesis, so they live on other organisms or on decaying organic matter. They are threrfore either saprophytic or parasitic. Fungi are extremely common and are widespread in distribution, but fortunately only a few of them are pathogenic. The warmth and humidity of the tropics are particularly favourable for their multiplication. The line that separate them from the bacteria is tenuous in some instances. They are more resistant than bacteria

to drying, alcohal, and the action of antibiotics, which after all are derived primarily from fungi.

Coccidioides immitis[47]. In man and animals, this fungus occurs as thick walled endospore- filled spherules and appears as a fluffy white cottony mould. It is responsible for coccidioidomycosis, which is a highly infectious disease. The usual primary form is an acute, disabling, selflimiting respiratory infection resembling influenza with usually a low grade fever, and a slight cough. The secondary, progressive form is a chronic, malignant, disseminated infection which involves any and all organs of the body, including the skin and bones, and produces numerous abcesses. A primary localised form of infection may occur on the exposed surfaces of the skin. Dust, soil and vegetation contaminated with spores of this fungus are sources of infection. Transmission is made by inhalation of spores in dust from soils and dry vegetation and possibly through skin scratches or wounds. The incubation period for the primary pulmonary form is 10 to 21 days, the average being about 12 days. The disease is noncontagious. Small epidemics may occur in hot, dry seasons when large numbers of individuals, such as military units, are stationed in endemic areas or engaged in manoeuvres in these areas.

Histoplasma Capsulatum[48]. The fungus appears as small oval, yeast-like intracellular bodies in the tissues of man and animals. Histoplasmosis, the disease caused by this fungus is a chronic, local or systemic, infectious disease of man and other animals. It is characterised by low grade granulomatous lesions of the skin and tuberculosis like lesions on the lungs and by involvement of internal organs, especially the spleen and liver. Dust contaminated with spores of this fungus is a source of infection. The agent has been recovered from man, dogs, cats, rodents, skunks, and opossums and from the soil and water. The transmission is usually by inhalation of spores in dust from soils and dried organic matter, it may also be transmitted by ingestion or through skin scratches. In the few reported epidemics, symptoms appeared within 5 to 18 days. The disease is non-contagious.

Nocardia asteroides[49]. This aerobic fungus has characteristics of both moulds and bacteria and has been classified in an intermediate position. The disease caused by this Nocardiosis, a severe pulmonary infection, is similar in many respects to tuberculosis but tends to form numerous abscesses instead of tubercules and is characterised by chronic pneumonia. It tends to spread to other organs of the body, especially the brain, where abscesses are formed. Pulmonary infection is characterised by a general malaise,

fever, a productive cough, night sweats, loss of appetite, and loss of weight. Brain involvement presents symptoms of headache, nausea and vomiting soil, dust or vegetation contaminated with the organism are the main sources of infection. The disease is transmitted by contaminated dust and possibly by droplet infection or through pus and other discharges from infected individuals. Skin infections usually result from contamination of wounds or scratches. The incubation period in man is unknown; experimental infection in guinea pigs is usually fatal with in a week.

v. TOXINS:

The clear scientific distinction between 'Chemical' and 'Biological' does not always apply in the way agents are classified and discussed. The 1972 biological warfare convention includes a class of chemicals which are extracted and purified from biological entities but are themselves not living and, in some cases, may be duplicated synthetically in the laboratory. These include the dedliest organic materials known and are known as 'biotoxin' or often just 'toxins'. They fall into three main subdivisions.

i. Phytotoxins : Which are vegetable-based.

ii. Zootoxins : are found in animals.eg.snake venom, certain species of frogs and fish are sources for some of the world's most deadly poisons.

iii. Microbial toxins : are found in fungi and bacteria.

With a few important exceptions, toxins based on protein are the most lethal but they also tend to have higher molecular weights, which proved a draw back in trying to turn them into battlefield weapons.

Ricin[50], a castor bean based poison, has been widely known and studied for years. It is one of the most deadly known poisons in the world and is some 25,000 times as toxic as strychnine. Ricin apparently consists of glycoprotein bands which divide into two peptide chains (A and B) upon attacking a cell. The A chain, and possibly the B Chain as well, enters the cell and carries the toxic constituent into the cytoplasm. There is no known effective antidote and Ricin is extremely difficult to trace in a postmortem. In a watery solution, ricin becomes unstable at temperatures above 60 to 75 degrees centigrade and, in a solid form, after about 100 degrees.

Botulinum toxin, formed by the botulinum bacillus, has received most military attention. Through repeated purification procedures, it has been obtained in a crystalline form. There are at least five distinct types A,B,C,D and E, of which types A,B and E are known to be toxic to man; C and D are toxic for animals and probably for man. Botulism is a highly fatal, acute poisoning. It

is characterised by vomiting, constipation, thirst, general weakness, headache, fever, dizziness, double vision, paralysis of the muscles involved in swallowing, and difficulty of speech. Respiratory paralysis is the usual cause of death. Sources of the toxin are bacteria clostridium botulinum and clostridium parabotulinum. The principal reservoir of the bacteria is the soil. Transmission is through eating of food contaminated with the toxin. Symptoms of poisoning usually do not appear until between 12 and 72 hours after food containing the pre-formed toxin has been consumed.

Saxitoxin[51](TZ) is a non-protein neurotoxin originally derived from california mussels and Alaska butter clams. The actual source is the plankton Gonyaulax Catenella which turns the shellfish poisonous when they feed upon it. Saxitoxin is much less toxic than ricin or botulin and is comparable to nerve gas in its lethality, but it is much more fast acting and stable poison than either of the other two.

T_2, DAS, Nivalenol and Deoxynivalenol. All are among the toxins produced by varieties of Fusarium fungi such as Fusarium tricinctum of the trichothecen group. T_2 toxin has also been isolated from Trichoderma lignorum which occurs in mouldy corn. Symptoms of trichothecene

poisoning include vomiting, blistering and internal haemorrhaging, while death is associated with lesions and haemorrhaging of the intestines, liver and kidneys. However the trichothecene toxins are relatively weak and this has caused some doubts as to their development into chemical weapons. Death from trichothecene poisoning is often prolonged and requires considerable dosages over an extended period of time. Therefore they are probably designed as incapacitants or rice pollutants. Many of the supposed chemical attacks have involved aircraft fired rockets emitting red or yellow smoke causing vomiting, diarrhoea and convulsions but few deaths.

Staphylococcus toxin, is produced in food by certain strains of staphylococci. It is an entero-toxin, since it has a specific action on the cells of the intestinal mucosa. It is usually characterised by sudden, sometimes violent onset, with severe nausea, vomiting, stomach cramps, severe diarrhoea, and prostration. The source of contamination is not known in most cases but is probably of human origin. Food implicated as sources of food poisoning are chiefly pastries, milk, milk products and meat. Food handlers who are nasal or skin carriers of pathogenic staphylococci or who have an open staphylococcal lesion on their hands, arms, or face have been traced as sources of poisoning. Incubation is relatively short. One half hour to 4 hours,

usually 2 to 4 hours, elapse between the taking of food and the appearance of symptoms. The toxin is probably the cause of acute food poisoning.

Batrachotoxin[53] is a highly lethal non-protein poison some four and a half times as deadly as saxitoxin. It is used by the Indians of the choco rain forest in colombia as a tainting agent for blow-gun darts. When the poison first began to attract serious interest by toxicologists, the only source was the skin of the south American arrow poison frog. The practical difficulties were great and, the frogs did not travel well and the toxin, once was found to be very difficult to work with. However, a batrachotoxin derivative has been synthesized with a toxicity of 1 microgram per kilogram compared with 2 micro grams for the natural product.

Tetrodotoxin[54], an another agent which has attracted considerable military interest, and this has had the advantage of a reasonably accessible source. It is extracted from the viscera and sex organs of certain species of puffer fish from a scientific point of view, one of the toxin's most intriguing features is its chemical identity with tarichatoxin. Tetrodotoxin is a public health problem in Japan, where the puffer is regarded as a delicacy, and much of the considerable work on it comes from Japanese researchers. Tetrodotoxin's mechanism of action is similar

to that of local anaesthetics and death is due to respiratory failure.

COMPARATIVE TOXICITIES (TOXINS)[55]

AGENT	NATURE	SOURCE	APPROXIMATE DOSAGE
Botulinus toxin A(X)	p	Bacteria	0.00003
Tetanus toxin	p	Bacteria	0.001
Ricin (W)	p	Plant	0.02
Palytoxin	np	Coelenterate	0.15
Crotalus toxin	p	Rattlesnake	0.2
Diphtheria toxin	p	Bacteria	0.3
Cobra neurotoxin	p	Cobra	0.3 MLD in
Batrachotoxin	np	Frog	2.0 microgram
Kokoi toxin	np	Frog	2.7 per kilo-
Tetrodotoxin/Tarichatoxin	np	Fish/Newt	8.0 gram.
Saxitoxin (TZ)	np	Dinoflagellate	9.0
Bufotoxin	np	Toad	390.0
Curare	np	Plant	500.0
Strychnine	np	Plant	500.0

Key: p - protein.
np - non-protein.
MLD - minimum lethal dosage.

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CHAPTER - III

:: APPLICATION OF WARHEADS ::

i. Means of Delivery.

   a. For Chemical Warheads.

   b. For Biological Warheads.

ii. Tactical Employment.

   a. Of Chemical Warfare Agents.

   b. Of Biological Warfare Agents.

APPLICATIONS OF WARHEADS

One of the alternative method of attack by a potential enemy is the application of chemical and biological warheads as destructive forces. Why should a potential enemy consider chemical and biological warfare, when nuclear weapons can achieve such vast destructive power? The answer is not complicated.

Military actions are not necessarily undertaken to destroy, but to occupy territory for which the occupier foresees a use. The use of nuclear weapons on an indiscriminate basis would undoubtedly destroy the facilities, which were the object of theenemy's aggression, or atleast render them worthless for post war use. To make its aggression worthwhile, these coveted productive facilities would have to be reasonably intact at the end of hostilities. To achieve this result, the enemy could use chemical and biological munitions, which could attack only people. By causing death or merely debilitating illness among industrial workers, their productive capacity would be lost or severly limited. And with this decrease in production, the enemy's armed forces would soon become seriously weakened through the lack of munitions, equipment, food, medical supplies etc.

The another advantage in the use of such weapons,

which might appeal to an aggressor is their effectiveness. Casualties in world war first showed that a man wounded by gas had a fourteen times better chance of survival than did a man hit by flying lead or steel. An attacker might well consider that this causes a drain upon manpower reserves, since a man-fatal casualty needs 5 or6 other persons to care for him during convalescent period while a dead person has no such liability.

One final and vastly important advantage in the application of these warheads is the fact that the utilization of various agents in the field permits the covering of large area to advantage with minimum efforts.

(i) MEANS OF DELIVERY :

The group for research and information on peace has estimated[1] that a one megatonne nuclear bomb would affect 300 square kilometres. Fifteen tonnes of neurotoxic agents would affect 60 square kilometres and ten tonnes of biological agents would contaminate almost 100000 square kilometres.

But, whether they are chemical or biological, the efficacy of these special weapons is measured by how effectively they are employed and the way in which they are spread.

There are four methods[2] of chemical and biological contamination:

- By Explosion.
- By Evaporation.
- By Spray.
- By Dispersion.

The first is effected by the use of explosives. It is a simpler and easiest method to disperse the chemical and biological warfare agents in the environment through mortars, bombs, grenades etc. Percentage of dispersion depends upon the proportionate quantity of explosives in the warheads. Highly evaporative matters such as cyanogen chloride or phosgene does not require excess quantity of explosive but less evaporative matters e.g. Mustard gas or nerve gases need more quantity, for a desired and homogenous distribution of the agents. Usually the ratio between an explosive and a nerve gas is 1:2.

About 15% of the nerve gas particles, after explosion diffuse in the air, 60% settle on the ground with in a diameter of 20 metres, while remaining percentage of particles, chemically change. Small particles enter the human body, while the large-size, which settle on the ground, may come in contact of exposed parts of the body.

Warheads containing solid contaminated agents are

effective only when the agents are finely powdered, but this is not an easy job. The finer powdered agents may aggregate into balls after explosion. To over come this problem, other chemicals such as colloidal silica is usually mixed with the powdered agents. To avoid the harmful effect of explosion as well as environment, the microcapsules of powdered agents may be produced.

It has been observed that the agents particles less than 5 micron diameter may not be used in these ammunitions except shape-charge ammunition. Therefore, to control the movement of fine particles, the vapour of ethylene-oxide is produced around the explosion-site. This protective cloud by detonation, helps in the spread of agents particles to far off places.

The application of evaporation method is very limited because the agents decompose due to high temperature of burning material mixed with the agent. If highly boiling-point liquid agent is evaporated, its vapour condenses into particles of 1 micron diameter and disperse in the air. Based on this very principle some chemical agents are mixed with inflammable matters. As these matters burn, the chemical agents vapourise and distil in the atmosphere. This method was successfully used in the second world,war and mustard gas was evaporated with the help of generators.

Spray of agents in liquid form is easy but solid agents are first converted into solution and then sprayed with the help of fine holed nozzle in the atmosphere. It is mixed and dispersed with the help of high velocity wind. It is advisable to apply this method when the aeroplane spray tank is flying at a low height say about 100 metre above the ground, because due to high altitude and speed of aeroplane a sheer-force is applied which transform the liquid into small drops resulting its vapourisation before they reach to the target.

For the dispersion of solid chemical and biological warfare agents, some times compressed air is used. Dispersion equipment or disperser are tied at the back or behind the tanks, heavy armoured vehicles or helicopters. The roter blades of a helicopter help in dispersion of particles of agent more rapidly.

Thus the application of the chemical and biological warheads can take place on the ground or from the air, depending upon the circumstances. On the ground, contaminated ammunition can be fired by mortars, cannons, howitzers, rockets, missiles, landmines etc.while the air raids are carried out by bombs filled with contaminated agents or by spraying.

(a) For Chemical Warheads :

Modern chemical warheads can be delivered by variety of means. The agents are released upon an area rather than upon a pin-point target. The method selected for liberating chemical agents, depend partly on the object to be attained and partly on the physical properties of the agents. They can be delivered:[3]

- From gas cylinders as gas cloud.
- From projectiles e.g. shell, trench mortar bombs or projectors as true gas or in the form of liquid or as fine dust,
- From aeroplane bombs as from other projectiles,
- By spraying from containers carried in aeroplane.

One of the most frequent charges in all gas projectiles would be a mixture of gas(Chemical agent) and high explosive (H.E.). The high explosive acts as a camouflage which is an aid to surprise. Any barrage put down upwind, therefore, be treated with grave suspicion. A gas-cum-High Explosive shell retains about 65% of the shattering power.

Bombs, shells, mortars and rockets may be charged with any type of chemical agent. There is no limit to size but the use of generators and cylinders is limited.

The original delivery system, the gas cylinder, is still a possible delivery system but overlooks the fact that many modern chemical agents are not gases but liquids or solids in some form or another that give off vapours at most ambient temperatures or are dispensed in aerosol or droplet form. Therefore, chemical agents may now be delivered from aircraft underwing tanks or containers, aircraft delivered bombs, artillery shells or by rockets, both guided and unguided. Infact, most modern delivery methods are basic and differ little from delivery systems used for other less lethal payloads such as screening smoke.[4]

Cylinder or cloud gas attacks are made by installing a larger number of steel cylinders containing compressed gas in the front line trenches and discharging these under suitable wind conditions so that the gas may be carried over into the enemy's trenches. The gas used must be denser than the air so that it does not rise when discharged, and it must be at a sufficient pressure to ensure that the contents of the cylinders are discharged repidly when the valves are released. Gas projectiles contain a toxic substance and a bursting charge, and the effect of burst depends on the nature of filling and the size of the burster.[5]

Mortars, cannons and howitzers owing to their calibre, range of action and high rate of fire, are supposed to

be the most popular and favourable chemical warheads delivery means. By these weapons, different types of shells or warheads can be fired to a desired distance. Such type of shell or warhead has a thin case, bursting charge, detonator and a fuze.[6] A few of the examples of such means are 122 mm Mortar (M.1943), 4.2" Mortar, 240 mm Mortar(SM-240), 122 mm Howitzer (D-30), 152 mm Howitzer(D-20), Howitzer SO-122, 155 mm Howitzer (M-114, M-198), 130 mm Gun (M-46), 152 mm Gun (1976), Self propelled Gun 255, 180 mm (SO-203) etc.

Several types of rocket weapons used for smoke and high explosives may equally well to fire chemical warheads of any filling. Since some of these weapons are six-barreled and all six can be fired almost simultaneously, they would be capable in battery strength of putting up a terrific gas concentration in a very short time. Fortunately, rockets can clearly be seen coming over in day-light, and at night the flash on discharge is distinct and unmistakable. In most cases it should, therefore, be possible to get protection before the bursts, for the gas concentration set up by such a salvo permits of no breathing once they have arrived. Now multiple rocket launchers and different types of free and guided missiles are in the service of different forces of the world. In warheads of guided rockets such as Little John, Honest John, Sargent, Lance etc.the filling of

chemical warfare agents ranges from 31 Kg to 217 Kg.[7]

Aircraft delivered bombs, although an exceedingly convenient way of taking chemical warfare agents to distant targets, have their limitations. Such bombs are much larger than a high explosive bombs of the same weight. A capacity per plane, therefore, is reduced. Nevertheless, any type of agent can be dispersed by these bombs. An ordinary such bomb has a thin case with small bursting charge, which is sufficient to break its case. Like the shell it sounds rather like a dud. Their size varies from 100 lb to 4000 lb or more. America has introduced 100, 115, 125, 500, 1000 and 4000 lb. aircraft delivered chemical warheads filled with different type of chemical agents such as lachrymators, mustard gas, phosgene, cyanogen chloride, sarin etc.for her forces.

For aircraft spray, the agent should be in liquid form. Different kind of chemical agents can be sprayed from any height depending upon the nature of agents and other factors, but since the rate of fall is slow and the agent liable to be wind, a plane must come down to 1000 feet or less to gain any accuracy. For low level spray attack against specific targets a fast type of fighter-bomber is best suited. The liquid is carried in a tank and released in a large jet. This jet disintegrates in the air,causing the liquid to split up into drops, most of which falls

down wind of the course of the plane. No area of contamination can be given for any specific height. Much will depend on the:[8]

- Height and speed of aircraft
- Direction and speed of wind
- Quantity of agent released
- Weather conditions.

LIKELY DELIVERY MEANS (Chemical Agents)[8A]

AGENT GROUP	AGENT	DELIVERY MEANS
Lethal (Nerve)	Tabun	Artillery shells, Aircraft bombs.
	Sarin	Artillery shells, Aircraft bombs.
	Soman	Artillery shells, Aircraft bombs.
Lethal (Blood)	Hydrogen Cyanide	Multiple Barrel Rocket Launchers
	Cyanogen Chloride	Multiple Barrel Rocket Launchers
Lethal (Choking)	Phosgene	Artillery shells, Aircraft bombs.
Damaging Blister	Sulphur Mustard	Aircraft spray/rocket, Air-burst missile, Artillery shells, Aircraft bombs.
	Mustard-T Mixture	Multiple Barrel Rocket Launchers
	Lewisite	Multiple Barrel Rocket Launchers

AGENT GROUP	AGENT	DELIVERY MEANS
	Phosgeneoxime	Aircraft spray/rocket, Artillery shells, Aircraft bombs.
	Mustard Lewisite mix	Artillery shells, Aircraft bombs
Incapacitating	Quinuclidinyl Benzilate	Artillery shells, Aircraft bombs, Aerosol sprays.

Besides those weapons already mentioned, the different countries of the world may have variety of weapons for contaminating buildings, ground, troops etc. with chemical warfare agents. Soviet Union now deploys chemical warheads on 16 different weapons, including aircraft bombs, howitzer rounds, mortar rounds, land mines, grenades, multiple rocket launcher, free rockets over ground and tactical ballistic missiles. There is also evidence that Soviet cruise missiles may have been provided with chemical warheads.[9] An another record reveals that USSR has adopted 150 ICBM for delivery of such warheads[10] and SS-19 has been tested as such a warhead version.[11]

Like USSR, United States and different NATO countries have also introduced different kinds of chemical warheads and their means of delivery such as wetey aircraft bombs, sergent guided missile, Pershing and Lance nerve gas

warheads, C-114B aircraft, M 687 155-mm GB2, artillery projectiles, BLU 80/B 500-lb VX2 spray bomb, XM 135 warhead and new multiple launch rocket system[12] etc.

SOVIET & UNITED STATES: DELIVERY MEANS
(Chemical Agents)

SOVIET UNION	Estimated capability for CW-agent delivery (Kg per weapon)		UNITED STATES
5-25 Km maximum range			
122 mm mortar (M 1943)	100/5 Min	150/5 min	4.2-in mortar M30
240 mm SP mortar SM-240	80/5 min		
122 mm how D-30 & SP how SO-122	40/5 min	40/5 min	105-mm how M102
152 mm how D-20 & SP how SO-152 M109	50/5 min	50/5 min	155-mm hows M114 & M198 & SP how
203 mm SP how(M1975)	-	40/5 min	8-in SP how M110
122 mm/12 MRL(M1975)	40	-	-
122 mm/36 MRL(M1976)	110	(220)	(Abandoned:115-mm/ MRL M91)
122 mm/40 SP MRL BM-21	130	-	-
25-150 Km maximum range			
130 mm gun M46	50/5 min	-	-
152 mm gun(M1976)& SP gun 255	50/5 min	(50/5 min)	(Abandoned:155-mm gun M59)

SOVIET UNION	Estimated capability for CW-agnet delivery (Kg per weapon)		UNITED STATES
180 mm gun S-23	30/5 min	-	-
203 mm SP gun SO-203	-	-	-
220 mm/16 SP MRL BM27	700	500	227-mm/12 SP MRL
550 mm FFR R-75 Luna (FROG-7)	180	220	762-mm FFR Honest John
SSM(SS-21 Scarab)	-	-	SSM ATACMS
<u>150-500 Km maximum range</u>			
Assault helicopter Mi-8 (Hip)	upto 650	-	-
Assault Helicopter Mi-24 (Hind)	upto 650	-	-
SSM(SS-1c Scud-B)	360	-	-
Carrierborne FGA Yak-36(Forger)	upto 350	upto 1000	V/STOL aircraft AV-8 Harrier II
FGA aircraft MiG-21(Fishbed)	upto 350	-	-
Naval SSM (SS-N-3 Shaddock)	450	-	-
SSM(SS-23 Spider)	-	-	SSM JTACMS
CAS aircraft Su-25(Frogfoot)	upto 1600	upto 1400	CAS aircraft A-10 Thunderbolt
<u>500-1000 Km maximum range</u>			
FGA aircraft Su-17(Fitter)	upto 2000	-	-

SOVIET UNION	Estimated capability for CW-agent delivery (Kg per weapon)		UNITED STATES
FGA aircraft MiG-27(Flogger)	upto 1500	upto 1400	FGA aircraft F-4 Phantom II
SSM(SS-12/12M/22 Scaleboard)	320	upto 1000	Carrierborne FGA A-6 Intruder
<u>1000-5500 Km maximum range</u>			
Bomber aircraft Su-24(Fencer)	upto 1500	upto 1800	Bomber aircraft F-111
SSM(SS-20)	250	-	-
<u>Maximum range greater than 5500 Km</u>			
SSM(SS-11 Sego Mod 4)	500	-	-
SSM RS-18 (SS-19 Mod)	1500	-	-

<u>KEY</u>

SP : Self propelled

MRL : Multiple rocket Launcher

SSM : Surface to surface guided missile

CAS : Close air support.

how : howitzer

FFR : Free-flight rocket

FGA : Fighter/ground-attack

Nonpersistent lethal types of chemicals are dispensed as vapours or aerosol drift down wind, endangering people and livestock until diffusion and evaporation dissipate them below disabling levels. Volatile agents that linger no more than a few minutes, even on calm days, are well suited to "soften" defensive formations, which airborne, amphibious or land forces then can assault while wearing no protective equipment, except masks. Troop concentrations, strongpoints, tanks, armored carriers, command centers, bypassed pockets, and fire support, including nuclear delivery systems, are high priority targets.

A volatile substance like phosgene forms a small cloud which drifts with the wind, while with a liquid like mustard gas part of the filling is dispersed as a cloud, but considerable proportion will be scattered over the ground in or near the shell crater and may continue to give off dangerous concentrations of vapour for days. A solid such as diphenylchlorarsine is dispersed as a cloud of fine dust which drifts down-wind leaving no persistent effect. Similar results are obtained with aeroplane bombs. Liquids can be sprayed either from tanks or aeroplanes, but in the latter case there may be considerable losses by evaporation if the drops have to fall from great height.[13]

Once released, the agents travel with air and wind

currents, gradually diffusing to point of noneffectiveness. This diffusion process varies with the agent employed and with temperature, wind speeds, terrain and other considerations. Once released in a target area, the behaviour and effectiveness of chemical warfare agents are greatly dependent upon the weather. The more numerous and larger the air currents, the more widely the chemical clouds are dispersed.

Under more stable meteorological conditions, i.e., low wind speed and slight turbulence, chemical clouds remain near the ground and may travel for long distances before being dissipated. Under less favourable conditions more munitions per target area are required to achieve the tactical results desired. Large area attacks can be made with wind speeds upto 12-15 miles/hour, whereas small area attacks are generally not effective in wind speeds of over 6 miles/hour.[14]

The degree to which temperature variations limit the tactical use of chemical agents is dependent on the physical properties of the particular agent; generally, however, the higher the temperature the less effective is a given quantity of any agent. Humidity does not seriously decrease the effectiveness of most war gases. High humidity coupled with high temperature increases the effectiveness of some blister gases such as the mustards.

Rainfall reduces the effectiveness of chemical clouds and may even cause them to be ineffective. Heavy rainfall will also wash away persistent liquid agents. Snow reduces the evaporation of persistent agents so that little vapour hazard exists. But contact with the liquid still presents a hazard. When the snow melts, the vapour hazard of the persistent liquid agents reappears. The behaviour and effectiveness of chemical agents are also affected by the contour and conditions of the surface of the ground and by the presence or absence of trees and vegetation.[15]

However chemical warheads require careful handling and storage if they are not be a hazard to their users as well as to an enemy. Many military chemical agents are corrosive and are thus inclined to leak from unprepared containers. It would appear that even moderate handling damage that would pass unnoticed with orthodox munitions can lead to leaks as well. Even a pin prick that will allow minute contents of a chemical agent container to escape constitutes a hazard to handlers and storemen. Chemical weapons such as shells and bombs therefore require special handling containers, storage and handling methods.

(b) <u>For Biological Warheads</u> :

Biological warfare involves the use of disease

producing micro-organisms bacteria, viruses, fungi and rickettsiae in support of military or paramilitary operations.[16] Biological warfare agents may be dispensed in many ways. The age old ploy of simply introducing infected persons or animals into a population is still a distinct possibility but other methods could include the dispensing of viruses in aerosol form from aircraft. The spreading of spores from aircraft bombs is another and vectors such as insects could be spread far and wide by releasing them into the efflux from a jet engine, either on the ground or from aircraft.[17]

There are two general methods of delivery:

- Direct.
- Via Vector.

Direct transmission simply involves creating sufficient amount of agent in the air to cause infection through inhalation or ingestion. This requires the creation of a cloud of infectious material over the area to be attacked. The cloud must be reasonably uniform. In other words, there should be a fairly even distribution of toxic particles in the required concentration. There are three methods of Direct biological contamination:[18]

- The first is effected by the use of explosives.

- Aerosols can also,be used. They eject under pressure a substance containing selected micro-organism in suspension.
- The third method involves spraying contaminated liquid in a jet of air at a great speed.

All three techniques are very sophisticated. But it is always possible, even though experts might think it fairly remote, that a single man - an enemy agent, for example-might poison a water supply or a ventilation system on his own.

Manufacturing a disease for military purposes is one thing. Spreading it to a significant number of personnel in a target population is another. When the organisms involved are spores or something similar, the task can usually be left to wind currents.

However, many disease require some living organism to carry them. These carriers are known as vectors and many long established diseases rely on vectors such as mosquitoes, rats, lice and other similar unpleasant living things. Thus a Vector is an animal or insect which transmits the disease from an infected individual to a health one. For military purposes such vectors have to meet a testing specification. They have to be bred in sufficient numbers

and have to have a survival life long enough to actually spread the required disease. They also have to be hardy enough to endure long periods of storage and be dispensed from either high altitude or in extremes of climate. Insects such as mosquitoes can meet such requirements and have been bred in huge numbers for various military biological warfare campaigns.[19]

Intensive research has been done to prepare filling for biological delivery systems which would distribute a relatively uniform cloud of particles. In most cases, the lethal cloud must be distributed as quickly as possible because the majority of biological warfare agents are highly sensitive to environment variable such as heat and ultraviolet light. Therefore, night time has always been considered the best time for biological attacks.

There are many biological warfare agents which infect through wounds or abraisons in the skin but this has not been considered a primary means of attack because it would only create a hazard for troops already wounded or injured. Particular projects developed biologically contaminated artillery and mortar shells as well as fragmentation bombs to cause skin infection additional to blast and shrapnel effects but these are of less general interest than munitions designed to create lethal clouds

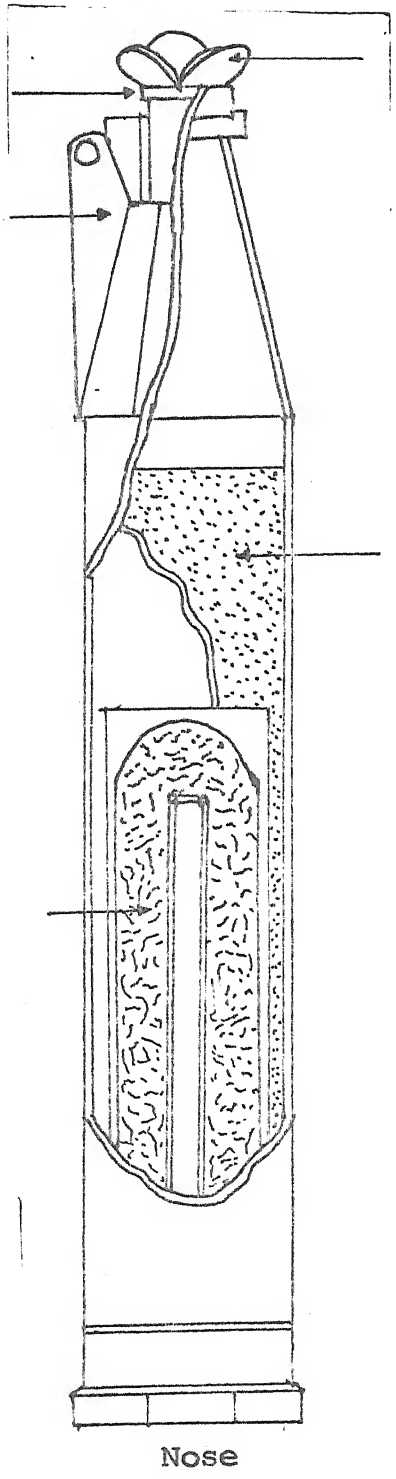
challenging the lungs. Tainting conventional rifle or machine gun ammunition with toxin is another approach but these special purpose munitions are not intended for large scale use.

Skin penetration is the most lethal means of delivering toxin agents but it is not practical for attacks designed to infect large number of people over a wide area. The overall effectiveness of biological weapons is, therefore, determined by two considerations:

- the efficiency of the agent in causing death or incapacitation and
- the efficiency of the actual weapon.

In previous wars, the effectiveness of air-delivered biological weapons was increased by using numerous small bomblets or aerosol type dispensers rather than a few large devices, which tend to concentrate the agent around the point of dispersal giving uneven distribution and wasting material by creating concentrations far in excess of the required effective dosages. Saturating an area with numbers of small weapons, however, created individual agent clouds which were more likely to evenout into a single cloud with a more uniform distribution.

The first modern biological weapons were explosive bomblets filled with a slurried mixture containing a



BIOLOGICAL WARFARE BOMBLET
(dry particles)

percentage of micro-organisms. Now improved munitions have been developed which do not depend upon the use of an explosive charge. They include hydraulic atomization of a liquid agent filling by using gas pressure to force it through a nozzle so as to create a fine spray. Another pressure system force solid 'dry' particles of agent out of a container. A dry agent payloads contain higher proportions of micro-organisms than liquid fillings but some biological agents seem to have been more suited to slurried fillings. Dry-agent fillings also appear to have put far greater cost and safer constraints upon production.

Another method for distributing biological agents employs spray tanks carried by aircraft. Since 1957, North American aviation and many other agencies of the different nations are working in this field to research the possibility of launching large-scale attacks of biological weapons from low-flying aircraft. The idea is to use a pressure source to eject a liquid agent filling through a fine nozzle.

Many countries of the world have developed and tested different type of biological warheads and their means of delivery such as Uji bombs, Ha bombs, cluster bombs, Anthrax bombs, Cattle cakes etc.and spraying of bacteria emulsion has also been experimented.[20] Masterly

over the cultivation of infected flea as a biological weapon has been achieved. A record reveals that these were tested by being dropped in porcelain aircraft bombs. Later the Japanese carried out successful experiments in spraying the fleas from high altitudes.[21]

Stability is another important consideration because agents have to retain their desired properties for acceptable periods of storage, during production and in use. Many selected agents have storage lives of a few months although some are stable for longer periods. But storage usually requires fairly stringent standards of refrigeration. Stability in production has sometimes proved difficult because the process and the growth medium contribute to undesirable mutations. Equally, however, the production medium and process can be exploited for the intentional manipulation of mutations to breed desired qualities into a new strain of the organism, but this may also bring about unwanted secondary effects- a strain with higher virulence but lower stability, for example. It has been found that the means of dissemination could also render large proportions of the micro-organisms ineffective, since they are sensitive to such things as heat and blast.

The agents need to have a minimal immunological tolerance in the target population. Public health programmes

and natural selection have reduced the number of diseases which would be suitable biological agents. One answer has been to breed strains for which there is little or no natural immunity and no available vaccine, such as anthrax and plague. Ideally, suitable vaccines would be available- but only to the user. However, this is a condition which is difficult to fulfil in a world where such scientific discoveries tend not to remain secret for long.

The time between infection and effect varies widely with various diseases, making a low incubation period an important consideration. For battlefield uses of biological agents the longer this delay the more impractical the weapon. This is the main reason why biological weapons have never been considered to be of much tactical use. But there are certain exceptions. During the 1962 Cuban missile crisis, a proposal to spray Cuba with an incapacitating biological agent- Q-fever, possibly in conjunction with tularaemia- was seriously proposed as a 'softening-up' exercise before an invasion. The attack would have been carried out with a sufficient time lapse before the actual invasion to allow the disease to take hold.

Most selected biological agents have been chosen for their low or non-existent potential for creating epidemics, as highly contagious diseases carry the problem of

reciprocity and may eventually infect the user as well as the victim. However, epidemic-producing diseases such as plague have been intensively investigated, probably because of the fear that the Soviet Union might have gained an advantage in understanding the mechanisms by which human epidemics take hold.[22]

There are any number of variables which will influence the extent and severity of an epidemic. They include the efficiency of the health services. With vector-borne diseases, there is an ecological relationship between the human and carrier population, and social dislocation may lead to an increase in the number of vectors and a consequent rapid rise in incidence of the disease.

Thus biological warfare would seem to be a very viable course of action to take in any future conflict. However, biological warfare is not easy to conduct. Any attempt to lay large number of people low with some form of illness, disabling or death, is a slow and uncertain process even now.

(ii) TACTICAL EMPLOYMENT :

Some general differences between biological and chemical warfare may be noted. Whereas chemical means are entertained in connection with both tactical and strategic

warfare, biological means are considered mainly feasible in connection with strategic warfare alone; possibly, because of the time they take to have the desired effect. Both are considered suitable for purpose of sabotage. Finally, unlike chemical warfare, biological warfare has not been applied systematically in recent times and those concerned with it have little practical experience on which to draw.[22A]

(a) Of Chemical Warfare Agents :

Chemical warfare weapons are no longer the killers they once were. When used against prepared troops, chemical weapons are rarely casualty producers. Instead the very suspicion of a chemical weapon strike is enough to make troops do their protective garments, close down vehicles, and generally go to ground inside protected facilities. Once so contrained troops may be regarded as degraded in their combat potential. They can not carry out their normal combat functions. Protective garments and respirators impede action and make any weapon difficult to handle or serve. Closed down vehicles lose much of their surveillance capability and can become virtual sitting targets. Troops herded into a shelter can not move or fight. Thus chemical weapons become extremely effective and economic options in military terms.

Their drawback is that they impose similar

restrictions on an attacker. If an attacker is to make use of the ground rendered relatively defenceless by a chemical strike, that ground must be occupied by troops. But those troops will, in their turn, have to assume their own chemical defence measures and will then be prone to the same combat degradation factors as the helpless defenders.

Thus, chemical warfare is a two-edged weapon. It does have distinct tactical uses. such as the spreading of persistent agents along the open flanks of a deep armoured attack. Any attempt by defenders to make a flanking counter-move will have to traverse an area covered with harmful agents. Equally, a defender might well saturate areas with similar substances to deny their use to an attacker and force the attacker to move only against well-defended localities.

Leaving aside the possible tactical employment of chemical warfare, one aspect of chemical warfare that can not be overlooked is its sheer upleasantness. Ever since the first world war when chemical weapons were first employed on a large scale, the very thought of 'gas' warfare has evoked visions of blinded men stumbling across the ypres salient, an image that still causes revulsion in even the most hardened of hearts. The newsreel images of Halamjeh can not fail to reinforce that revulsion. Yet, it should not

be overlooked that in both instances the unfortunate casualties were totally unprepared for their ordeal.[23]

Chemical warfare agents may be employed in either tactical or strategic operations. The effects of these agents range from harassment of personnel to instantaneous lethal effect. Chemical agents also permit interdicting and obscuring target areas.

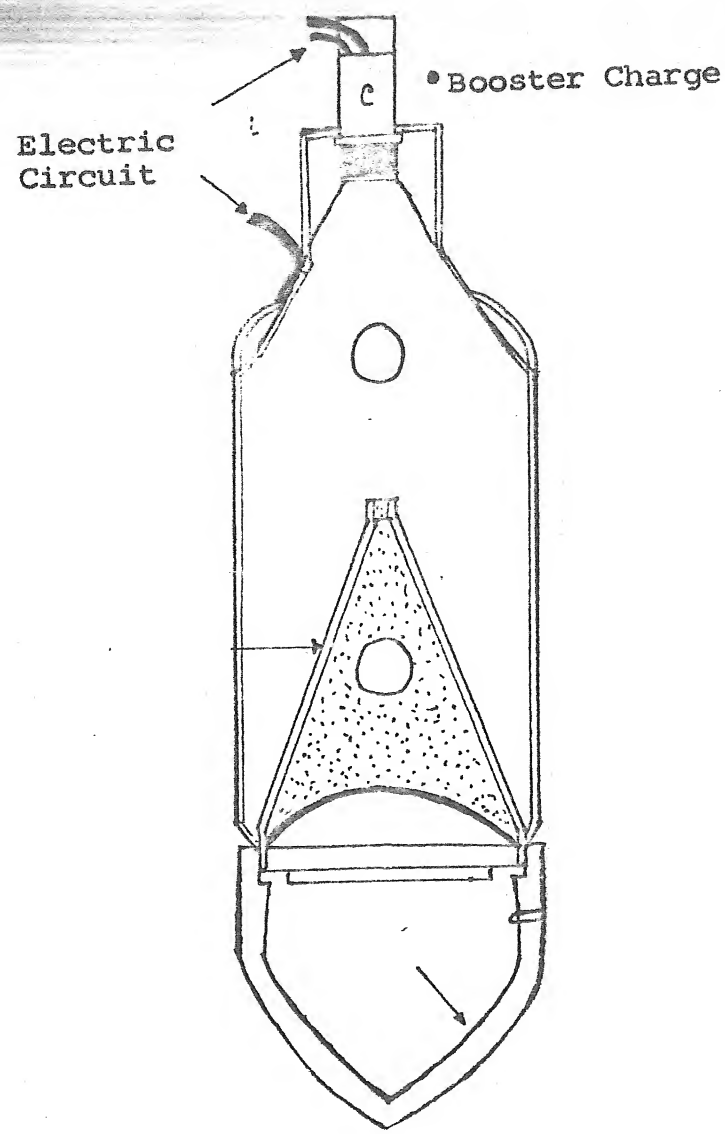
The flame and incendiary agents are also capable of material destruction. The high persistent agents can be employed to deny terrain to the enemy unless it is willing to absorb a high number of casualties by crossing or occupying the contaminated area. The wide range of agent-munition combinations permits a range of effectiveness in the area of release from a few minutes duration to indefinite periods ranging into days or months.

Compared with conventional chemical agents particularly high explosives which act instantaneously at the impact point, chemical munitions afford a distinctly wider range of effectiveness. Conventional, atomic or thermonuclear munitions have a definite radius of effectiveness. Chemical agents, on the other hand, are effective not only in the area of release but also for considerable distances downwind from the place of release. Chemical warfare agents, moreover, flow with the air currents. Thus, being independent

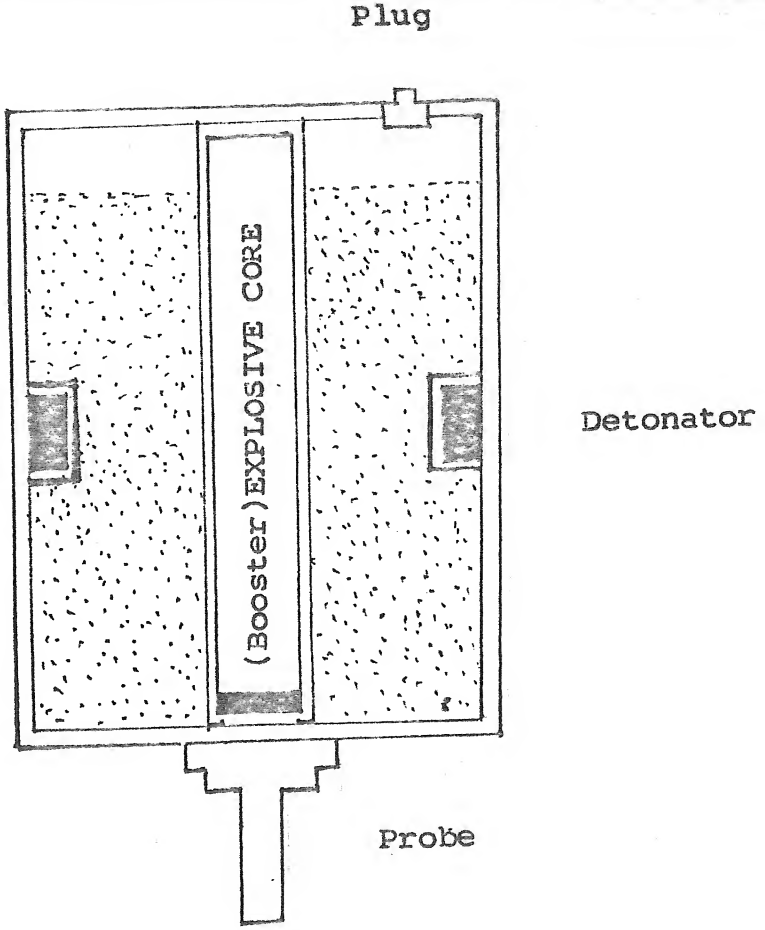
of trajectory in the area of release, they will penetrate defences that normally give full protection from the effects of other weapon systems. The mobility of toxic gas clouds may be 5 to 25 times larger than the area of release.[24]

The tactical advantages of chemical weapons can be duplicated or exceeded by improved conventional munitions. Fragmentation artillery shells, for example may prove far more effective against troops in the open which are well prepared in chemical defences. Ptentially far more effective yet in battle are fuel air munitions. Fuel air explosives are said to be virtually undetectable by smell and, once treated, the ground remains effective for more than a day. Longer lasting fuels are under development. Such an approach could be a far more effective and predictable area-denial technique than persistent chemicals.[25]

Fuel air explosive may be inserted into free-fall bombs, bomblets, artillery or mortar shells or rocket warheads. It is a liquid which forms a highly volatile vapour cloud when the weapon detonates and forces it outwards to mix with air. The size of the cloud depends upon the size of the weapon and may range from a few square metres to several tens of square metres. Along with the fuel air explosive liquid, the weapon ejects one or more detonators and after a pre-set delay they fire and ignite



CHEMICAL WARHEAD
(Shaped-charge TOW missile)



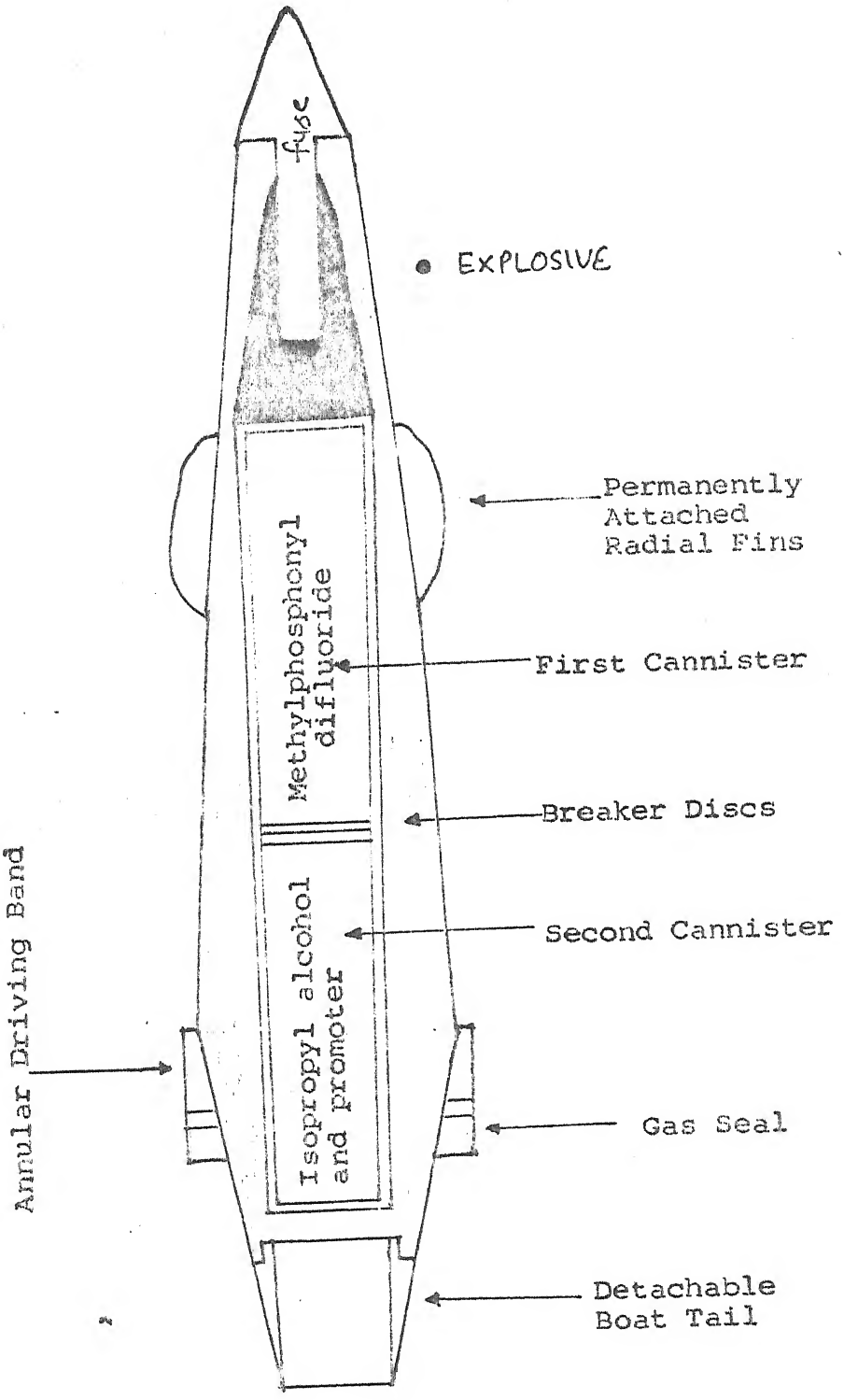
FUEL-AIR BOMBLET

the cloud creating a downward blast with a force of as much as several hundred pounds per square inch.

Production plans and facilities for a new range of chemical munitions exist in the different countries of the world. The payload of these new technology 'binary' shells and bombs consists of two chemical substances, difluoro and isopropyl alcohal amine, which while seperated are non-lethal (albeit toxic) but on being mixed form, the deadly, non persistent nerve agents GB2. As manufactured, each shell or bomb contains only difluoro, capped with a cardboard filler, and the isopropyl alcohal amine is stored seperately. The second chemical is only inserted into the shell or bomb immediately prior to loading and, even then, the two chemicals are in seperate compartments, not coming into contact with each other until the nose-fuse sets off an explosive charge, driving back a pusher plate which fracture the membrane between the two components and allows them to mix. Because it is non-persistent this chemical breaks down after a period of time, thus making decontamination of an affected area by friendly troops unnecessary.[26]

The advantage of chemical agents/weapons may be summarized as:[26A]

- It is possible to inflict casualties ranging from



EXTENDED-RANGE BINARY NERVE GAS ARTILLERY SHELL

almost death to mere discomfort or disorientation.

- Most plants and equipment remains undamaged while contaminated, although some items (notably aircraft cockpit canopies and some electronic equipment) may suffer corrosion in the long term.

- The effects are difficult to detect, by the time an enemy realizes he is under attack it may be too late to take a effective protective measures.

- Both the use and the threat of chemical weapons can have a severe psychological effect on the enemy, and inhibit his operations by compelling him to adopt protective measures.

- Chemical weapons can be effective against troops who are well protected against conventional and nuclear weapons.

CHEMICAL AGENTS WHICH MAY BE USED IN FUTURE WARFARE[27]

NAME	TYPE	EFFECT
Tabun (GA) Sarin (GB) Soman(GD) VX	Nerve Agents In gas or liquid form.	Breathing difficulty,runny nose blurred vision,nausea, sweating,vomiting,giddy, muscular spasms,paralysis, death.
Distilled Mustard or Nitrogen Mustard	Blister-Agents In gas or liquid form.	Eye and skin irritation. Blisters,external(and internal if inhaled or swallowed) Bronchopneumonic Effects, following initial irritation may be delayed up to 48 hours. Can prove fatal immediately or after years of illness.
Phosgene	Choking Agent Gas.	Damages lungs.Victim coughs and drowns in his own fluid.
CN DM CS BZ	Incapacitating Agents Gases.	Irritates eyes and skin. Breathing difficulty.Nausea and vomiting.For BZ,flushed skin,irregular heartbeat, high pulse-rates,hallucinations maniacal behaviour.
Botulin(X & A) Ricin Saxitoxin(TZ) Entero-toxin Tetrodotoxin	Toxin Agents In powder or liquid forms.	Blurred vision,tingling limbs, headaches,numbness,fatigue, cramps,breathing difficulty, dizziness,vomiting,paralysis, death.
LSD and other mind affecting drugs	Psycho Agents In gas,liquid, or powder.	High pulse rate,flushed skin, hallucinations,incapacity to think clearly,open to suggestion. Stupors. Unconsciousness.

(b) Of Biological Warfare Agents:

Principally a strategic weapon in a military sense, biological warfare agents could have a tactical use, even though the user might have to wait days or weeks for the effect to be felt. Since tactical plans for major operations must be made well in advance of the projected action in order to control day to day tactics and build-up supplies and forces, located opponent reserves could be infected so that they would be out of the fight regardless of their location when the attack is launched. The agents characteristics, the sanitary standards of the intended victims and their protective capabilities against biological warfare agents would have to be of prime consideration for such use.

Biological weapons are uniquely adaptable to sabotage. Very small amounts of biological material could cause extensive damage. They would be inconspicuous in use and their effects would be delayed. Because of the difficulties of detection and the delayed effects, it might be impossible to determine whether sabotage had been committed or an outbreak of the disease was a natural occurrence.

The use of biological agents could be so insidious that it could be done months or even years, before the actual outbreak of war without detection, thus, seriously

undermining the fighting strength of a nation prior to open conflict. Biological agents do not destroy manufacturing plants and buildings, but they might effectively neutralize them by making casualties of the workers in the plants,[28] through illness or death causing a loss in production or other services vital to a war effort. Also possible would be the undermining of the health of a nation by lowering the population's caloric intake through introduction of disease to grain crops or other growing food staples for one or two years before hostilities began.

The value of large-scale use of biological warfare had been neither proved nor disapproved by actual military experiences in the 1950S, although research and experimentation had established its advantages as a weapon. It has become known that the quantity of material necessary to infect varies with the degree of individual immunity. The quantity must be large enough to break through and overcome all the combined immunities, natural or acquired, which may be present. Lower dosages might stimulate body mechanism and create greater resistance to the particular disease, rather than cause the disease.[29]

The living habits of the people of non-sanitory minded nations, where frequent contacts with animals and disease reservoirs are the mode of life, tend to build up

immunities against disease, such populations would not be so susceptible to attack as would the people of the more sanitary minded countries. It would probably be impossible to introduce artificially and spread by epidemic any disease among populations where that particular disease is or has been prevalent. This follows from the intimate knowledge of the disease and its consequences possessed by the natives and the widespread natural immunity that would have built up among such people.

There is still another feature the importance of which should not be understimated. The term "biological warfare" may provoke feelings of horror and the mere threat of such an attack might well cause a significant psychological effect. Even if the direct effects of a recognised biological attack, as determined by the number of casualties, should be slight, the psychological influence of this "invisible, intangible, noiseless andodourless" threat could lead to panic and the collapse of morale with serious repercussions on the military effort. Each case of illness would,rightly or wrongly, be attributed to the biological attack. Even minor symptoms would be interpreted as the first signs of the artificially produced disease. This would lead to additional loss of manpower. Also the possibility that an enemy might use saboteurs as panic-mongers, spreading rumours of a biological attack, can not be overlooked. In such a

situation the "b" of biological operations might well be replaced by the "P" of psychological operations; the effectiveness of the latter would depend largely on the psychological state of the target population.[30]

Although it can be assumed that the psychological effect of an open biological warfare attack might equal or exceed the material damages, here too, the immunity problem must be met. For any group of people living in an area where disease epidemics are common would not be so mentally sensitive to a biological warfare attack as would the people of a section where epidemics are rare.

Should biological warfare ever be used, this happy state of affairs will no longer prevail. The medical technology that has produced so many improvements in medical care and cures is now able to produce new medical horrors for use as possible weapons. Genetic engineering has produced the ability to manufacture 'designer diseases' for which there is no quick and easy cure or palliative.[31] The same technology can produce disease carrying insects that are proof against known control methods. New poisons can be produced from one innocuous substance. Even the technology to alter and affect human behaviour and thought is available.

SOME BIOLOGICAL WARFARE WEAPONS[32]

	REPRESENTATIVE APPLICATIONS		
	PEOPLE	LIVESTOCK	PLANTS
Viruses	Encephalitis(5-60) Hepatitis(1) Influenza(1)	Hoof & Mouth(5-85) Poultry plague(90-100) Rinderpest(15-95) Swine fever(95-100)	-
Rickettsias	Typhus(10-40) Q-fever(0-4) Spotted fever (20-60) Tularemia(10-60)	Heart water (50-60)	-
Bacteria	Anthrax(20-100) Cholera(10-80) Glanders(50-100) Plague(30-100) Typhoid(4-20)	Anthrax(40-80) Brucellosis(5) Glanders(50-100)	Corn blight Rice blight
Protozoa	Amoebic dysentery Malaria Sleeping sickness	Coccidiosis	-
Fungi	Valley fever(0-50)	Aspergillosis (50-90)	Cereal mildew Corn rust Potato blight Rice blast
Toxins	Botulism(95-100) Staph infections Mycotoxicosis	-	-

Figures in parentheses indicate the percent of fatalities in untreated cases.

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CHAPTER - IV

PREVENTION AND DEFENCE AGAINST CHEMICAL & BIOLOGICAL WARFARE

1. PHYSICAL PROTECTION
    a. Individual Protection
    b. Collective Protection

2. MEDICAL PROTECTIVE MEASURES
    a. Against Chemical Threat
    b. Against Biological Threat
    c. Medical & Life Support Equipment

3. DETECTION AND WARNING
    a. Against Chemical Attack
    b. Against Biological Attack
    c. Warning & Detection Equipment

4. DECONTAMINATION
    a. For Chemical Agents
    b. For Biological Agents
    c. Decontamination Kits And Equipment

The prevention of and the defence against the effects of chemical and biological warfare must be well known to the populace, public health and agricultural organisations so that they may be alert and vigorously active when such an eventuality arises. Basically, prevention and defence would consist of detection and warning, prompt recognition of the object, protection of the organs of respiration and skin, decontamination and medical prophylaxis and cure. Some paraphernalia of such a system could be dealt with by numerous simple equipments. Others would require a great deal of attention for the use of sophisticated equipment and devices. The two super most powers of the world the United States and Soviet recognize this fact in their prevention and defensive measures against chemical and biological attacks.[1]

Although military personnel and small groups of people may be equiped and trained to defend themselves to a great extent, it would be impracticable for most of the nations to render sufficient protection for the whole bulk of civilian population. Thus it has been thoughtworthwhile to give various aspects of prevention and defensive measures in this chapter.

Keeping such an idea of prevention and defence of

men and animals against chemical and biological warfare requires a great deal of attention towards the future development of civil-defence preparedness in India as well as in the entire world. Definitely, it would prove indispensable in the defence of India.

1. PHYSICAL PROTECTION :

In the context of chemical/biological operations, protection is taken to indicate those measures by which respiratory infection is prevented. This is achieved by denying access of such agents to the lungs. Hence the most important piece of the protective equipment is the protective mask. Other parts of the body are of secondary importance, the small likehood of secondary infection from contamination can be further diminished by using protective clothing which can be discarded for decontamination. The same level of protection may be attained in enclosures such as rooms, shelters etc., by providing efficient filtration. The different aspects of protective equipment and collective protective equipment are discussed below.

(a) INDIVIDUAL PROTECTION :

Individual protection starts with properly fitted masks which filter out known vapours and aerosols. Respirators or protective masks are the first and most suitable

means of defence against most of the chemical and biological warfare agents. Therefore, to counter the use of such weapons on the battle field, most of the armies of different countries of the world have been equiped with a variety of protective masks and clothings. How effective such clothing is, is open to doubt. But research under simulated battle-field conditions seems to suggest that it does offer a measure of protection against certain agents atleast for a short-period.

The main functional part of the mask is the air filter with its fittings. It is a well know fact that particles mainly in the size range 1 to 5 microns in diameter reach the lower respiratory tract. Particles with in this range containing live micro-organisms are thus the cause of respiratory infection and it is therefore, the small particles against which the filter must be effective. The fibre filters consist of randomly oriented fibres of various materials. Filters for particles of 1 to 5 microns, based on their filtering capacity, are devided into four groups:[2]

- Roughing filters (removing 10 to 60 percent of the particles)
- The medium efficiency filters (removing 60 to 90 percent)
- The high efficiency filters (removing 90 to 99 percent)
- Ultra high efficiency filters (removing more than 99.99 percent)

The overalls are a single garment. The cagoule and its hood covers the head, shoulders and the opening behind the overalls. The NAP-more commonly known as a gas mask is the most important part of this equipment. It must protect the respiratory tract, the eyes and the face against nuclear, chemical and biological agents. It is made up of a moulded rubber face covering; a helmet consisting of a set of moulded rubber adjustable straps, two eye-pieces fitted with antivapour film, a case containing, and protecting the maintenance valve and a cartridge filter.

The cartridge is the essential element of the NAP. It is made-up of two parts, a paper anti-aerosol filter and an anti-vapour filter containing a bed of charcoal impregnated with a neutralising substance. It offers effective protection against poisons for up to five days.[3]

Standard uniform clothing of good quality affords reasonable protection against chemical and biological warfare agents. But economic, logistic and other reasons, it would be unrealistic at present, or in near future, to provision individual protective clothing as part of generally available equipment specifically meant to guard against chemical and biological agents. Small quantities of such clothing may, however, be needed for personnel performing special high risk duties.

At present a variety of significant masks and clothings have been invented and developed in different nations of the world. They are being enumerated below.[4]

USSR :

New Soviet NBC Respirator, Helmet-type Protective Mask(Model ShM), Protective Mask - Communication, Civilian Protective Mask(Model GP-4U & GP-5), Special Protective Mask (Model ShMs), Protective Cape/Groundsheet, Paper Protective Cape, Protective Suit, Impregnated Coveralls (Model ZFO-58), Heavy Protective Suit, Lightweight Protective Suit (Rubberised L-1), Rubberised Protective Coverall, Heavy Rubber Gloves, Protective Apron-Rubberised, Cooling-type Hooded Coverall etc.

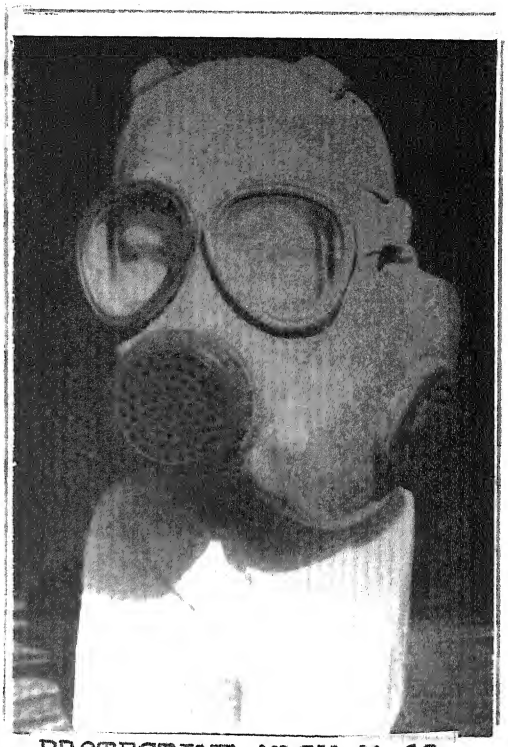
USA :

Mask Chemical-biological: Field ABC-M17,ABC-M17A1 and ABC-M17A2, MCU/2P, Special Purpose M9 and M9A1, Mask Chemical-biological: Tank M25 and ABC-M25A1, M40 and M42, M43 Protective Mask,Aircraft AH-64, MF-11 Military Respirator, NBC Mask for Dependents, Chemical Protective Outfit, Brunswick Chemical Protective Gloves etc.

U K :

Respirator NBC S-10, NBC S6, Negretti Aviation

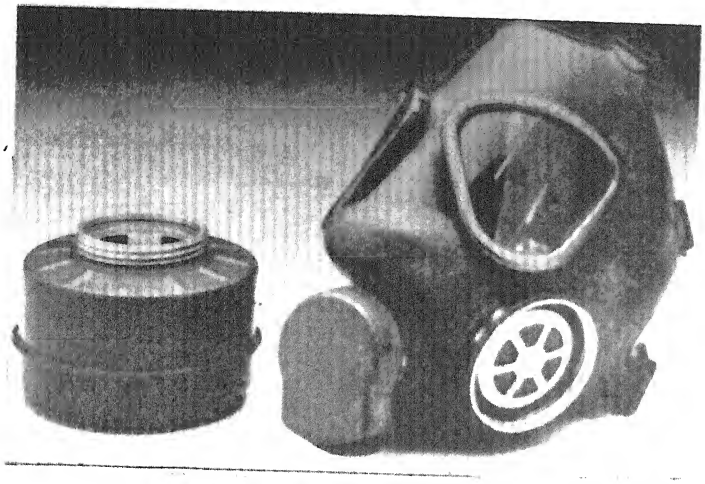
RESPIRATOR NBC S-10
(U.K)



PROTECTIVE MASK M-65
(CHINA REPUBLIC)

MASK
CHEMICAL-BIOLOGICAL
FIELD,ABC-M17
(USA)

MASK
MODEL ShMs(USSR)



KEMIRA NBC Respirator
M-76(FINLAND)

GAS MASK
CML-BIO C-3(CANADA)

SEKUR-PIRELLI M-59
NBC MASK (ITALY)

NBC PROTECTIVE GLOVES
(NETHERLANDS)

Aircrew System AR5, Protective Gloves NBC, Protective NBC Suit No 1, NBC Clothing for Aircrew, Protective Overboots NBC, Facelet NBC L1 A1, Suit Protective NBC-Decontamination No 1 Mark 1, Beaufort Maximum Protection NBC Suit, Maximum Protection NBC Suit, NBC Poncho, Heavy-duty Respirator, Lightweight Respirator, Complete NBC Kit-Civilian-Heavy duty, Lightweight Respirator, Complete NBC Kit-Civilian-Lightweight, Heavy-duty Outer Suit, Cambridge Hood etc.

FRANCE :

GIAT NBC Respirator, Protective Mask-Model ANP51 M53 and ME82, Protective Mask Type 'Gendarmerie'(G1), Paul Boye NBC Protective Uniform, Bachmann-TMB Model 63 Disposable NBC Suit, Bachmann-TMB Heavy Duty NBC Decontamination Suit etc.

CHINA :

Type 69 Protective Mask, Protective Mask M-65 and M-85, Protective Suit-Permeable M-82 and Butyl M-66 etc.

Except these five super powers Canada, Czechoslovakia, Belgium, Egypt, Bulgaria, Finland, Germany, Israel, Italy, Korea, Holand, Romania, Sweden, Taiwan, Yugoslavia etc.also have developed such means which are very much efficient.

But even the most efficient form of protective

clothing is uncomfortable to wear after a short-period and build-up body heat inside the clothing reduces the body's ability to function properly even under normal conditions. Moreover under battle conditions that reduction in normal body functioning is accelerated. Vision is another factor that is soon degraded. Every respirator produced to date reduces normal vision to some degree or the other and some more than others. Added to these combat efficiency degradation factors are difficulties in communication, the inability to recognize comrades, officers and N.C.Os, in serving and aiming weapons, and even in basic self-maintenance operations such as eating, drinking and body waste disposal. In a short time even the best-trained and motivated soldier becomes a helpless and useless burden to this military organization.

(b) COLLECTIVE PROTECTION :

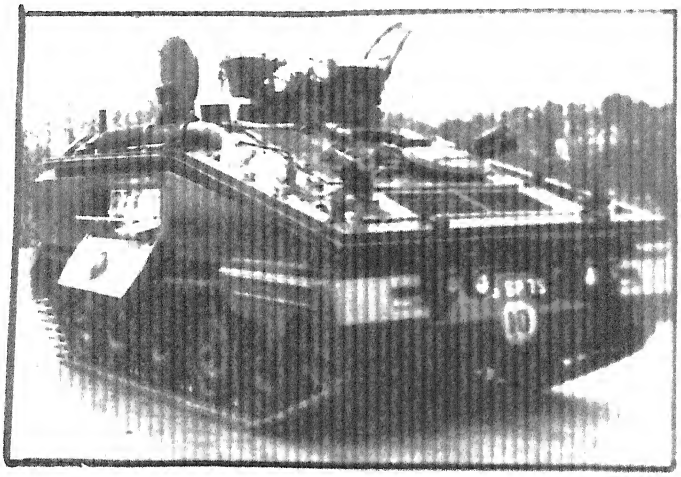
Collective protection assumes the form of fixed or mobile shelters capable of accommodating civilians as well as military personnel.[5] Shelters are man-made facilities which protect the people from contaminated air, chemical agents and from pathogenic microbes and toxins. Hence, a general discription of different types of shelters is needed. It should be noted that sealing or insulating the shelter will offer protection only for limited duration

because of lack of ventilation. The best kind of shelter provides ventilation with filtered air to keep positive pressure comparative to that outside. This positive internal pressure bars the entry of airborne agents and allows the entry of exit of personnel and equipment without any contamination of the internal space of the shelter.[6]

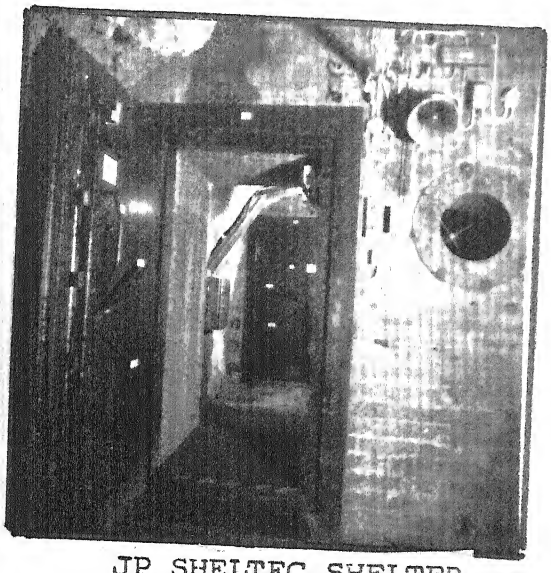
It is to be noted that an ordinary air conditioned office building, whose filters eliminate all particles down to one micron, about the size of most biological agents, provide quite good protection. Electrostatic precipitators remove all particles down to one micron.[7]

It would appear attractive to make office air-conditioning system proof against biological weapons, or atleast easily usable in case of enemy's attack so that the numerous air-conditioned blocks built in Indian cities could serve as bacteriological shelters if the need ever arise. Many buildings can be converted into temporary shelters if crakes, etc. are carefully sealed and a filter system with a ventilating mechanism is installed. Improvised can also be constructed using diffusion material containing glass, cellulose fibres and charcoal.

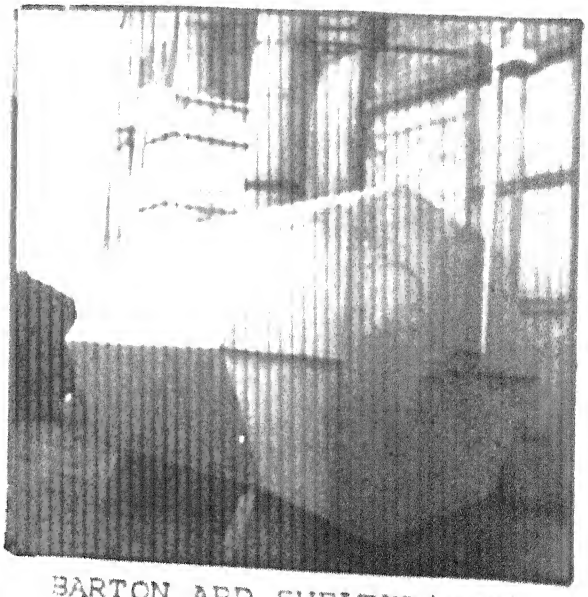
Transportable and fixed shelters, in appropriate combination, must provide "Sanitized" space for personnel to work, eat, sleep, relieve bladder and bowels, or



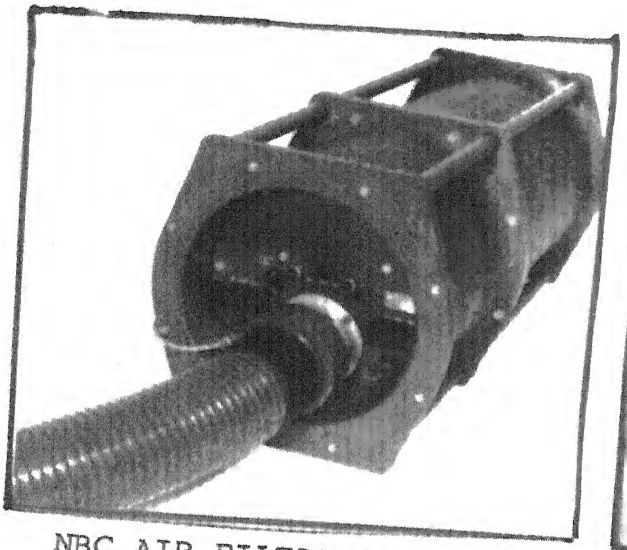
NBC, SPARTAN APC WITH NO.7
MARK 1



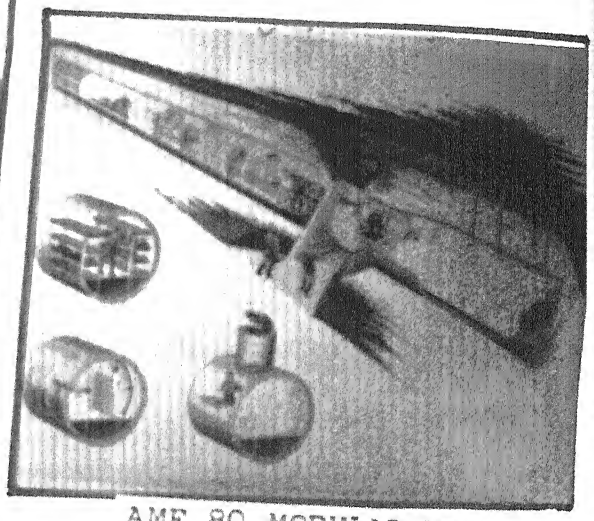
JP SHELTEC SHELTER
EQUIPMENT (SWEDEN)



BARTON APD SHELTER(U.K.)



NBC AIR FILTRATION UNIT
(U.K)



AMF 80 MODULAR NBC
SHELTER (FRANCE)

NBC COLLECTIVE PROTECTION
UNIT (FRANCE)

such as AMF-80 Modular NBC Shelters, AP 60 Modular Semi-hardened Shelter, Bachmann-TMB NBC Shelters, FMGC High Capacity Composite Filter, Sofiltra-Poelman NBC Filters, NBC Collective Protection Units for Surface Vessels, Moldip Igloo NBC Tent, Sekur NBC Filter Units, Bronswerk NBC Collective Protection Filter Unit, JP SHELTEC Shelter Equipment, BERICO Shelter Components, Barton APD Shelters, Heywood Williams Field Shelter MEXE Mk III, Beaufort NBC Field Shelter, M.D.H.NBC Protective Protection Equipment for Armoured Vehicles, M.D.H.Survivaire Shelter Filtration Unit, NGL Filtration Division NBC Air Filter Unit, Temperature Limited L1 A1 Portable NBC Filtration Unit, Temperature Limited NBC Filtration for Container Bodies, Temperature Limited Collective NBC Protection for Armoured Vehicles etc.

Finally we can conclude that todate very few attempts appear to have been made to protect any civilian population against the horrors of chemical/biological attack. Only a few nations such as Sweden and Switzerland have made any effective attempt to provide their populations with any prospect of protection, and that too only by the provision of deep shelters. It is in this area that much remains to be done. Instead, most governments appear to t ake the stance that to even consider the prospect of chemical and biological attacks against their civilian populations is

tantamount to political suicide, and thus quite simply ignore the subject. Therefore, it is in this field that much work required to be done.

2. MEDICAL PROTECTIVE MEASURES :

Medical protective measures or prophylaxis involves the prevention of infection and the destruction of the toxic agent with in the body before it can exert its toxic effect, or the reversal of its biochemical protection of susceptible sites with in the body. The objectives of medical protective measures in chemical and biological operations are:

- To manage casualties so that injuries or infection resulting from chemical/biological agents are minimised and, at the same time, any other injuries or illness are not aggravated.
- To protect persons handling contaminated casualties or working in contaminated areas.
- To avoid the spread of contamination in ambulances, other evacuation facilities, in medical treatment facilities and adjoining areas.
- To continue the operation of medical facilities so that other services, unrelated to the medical care and treatment of chemical injuries, are maintained.

Further, provision must be made to ensure that medical personnel are properly trained to manage and treat casualties contaminated with chemical and biological warfare agents and protect themselves from injuries and infection. Moreover, provision must be made for practice exercises to enable them to accomplish their responsibilities with speed as well as accuracy. Speedily undressing a casualty, for example, is achieved through practice.

(a) AGAINST CHEMICAL THREAT:

It has been reported in the available literature that no general prophylactic cure prevails in whole humanity which could render protection against chemical threat. The application of antidotes against nerve agents are of great importance if administered within half an hour before or within a limited period of exposure.[10] A terpenoid compound, atropine is toxic, however, it might inflict incapacitating effects upon the unexposed people given large doses. The use of numerous ointments made for the skin protection caused by vapours of blister causing agents can not be effective against liquid contamination. So far as the clinical approach against war gases is concerned, it can be dealt with systematically.[11]

The relief from gas casualties will be an essential

part of the general organization responsible for civilian casualties. As far as casualties incurred by asphyxiating or lung irritant gases are concerned, the first aid to poisoned persons should be carried-out by mobile mass units in the rear, and must give them complete rest to avoid exertion and perpetual care.[12] In certain preventive measures, inhalation of oxygen is highly required. Venesection, with or without intravenous saline infusion may be required. Simultaneously, sedatives may also be required but morphia is contradicted since it causes the depression of the respiratory system. Heart stimulants, such as hypodermic infection of pitutrin or camphor, may be required.

During phosgene intoxication, inhalation of oxygen tends to have a pathogenetically indicated during the course of the affliction. It is necessary to supply the affected people with oxygen during the first few days of acute period of intoxication, according to the condition of the individual patient. Bloodletting is regarded as basic measure for dealing with the edema of lungs and is required to carry it out in calculated quantities of the total weight of the patients.[14] After extensive bloodletting carried out in time, edema of lungs normally tends to diminish and resorption is discernible. It is necessary to mention that the casualties be kept as warm and as quite as possible.

As in the proposed future pattern for evacuation in Soviet,[15] India has also recommended similar steps. Such evacuation must be carried out without any delay to the still existing stationary hospitals or outside the populated area where affected persons undergo the complete course of treatment until they are fully cured.[16] In the course of Carbon Mono-oxide gas intoxication, during war, displacement from contaminated area is usually necessary and sufficient to check the toxic symptoms. In severe cases, when breathing tends to stop the following measures are necessitated:-

- Displacement of the casualties from the contaminated place.
- Cleanse the oral and nasal cavities of the vommiter,
- Stimulation of respiratory system by means of reflex stimulation and intravenous injection of hydrochloride lobeline,
- Re-establishment of blood circulation by administration of camphor, cardiazal, corasole, caffeine etc.
- Evacuation of complicated casualties of central nervous system to a fully equiped hospital.

There are certain chemical agents such as hydrocyanic acid, methyl isocynate and Cyanide, which may cause severe poisoning or even death. They may be prevented by antidotal therapy. In such cases the following preventive

measures must be adopted:

- Remove the casualties from the poisonous atmosphere,
- Manage artificial respiration,
- Manage simultaneous inhalation of antidotes such as ethyl nitrite or propyl nitrite and oxygen,
- Evacuate the casualties if they are not in a position to recoup so that unnecessary infection may not spread.

In the case of casualties caused by Tabun and Sarin, the first-aid is the injection of atropine sulphate. If the aforesaid chemicals have fallen on the skin, the turpenoid compounds are administered before the appearance of intoxication symptoms. To those casualties which feel suffocation, the alkaloid named ephedrine or papaverin are prescribed in the form of pills or powder. The significance of artificial respiration should be kept in view and it should be carried out until the normal respiration is re-established. Lobelin and cytitone are used for stimulating the respiratory centre.[17]

The first-aid for such casualties, which are affected by oral Tabun poisoning, required the administration of activated charcoal orally and thereafter gastric lavage with lime water is carried out. If the intoxication signs appears after a long duration, the casualties may be

shifted to any one of the nearest hospitals. Preventive measures are to be taken against such infection which affect skin. Such casualties should undergo total sanitary process by washing with warm water and soap and changing clothes and kit followed by rich diet with Vitamin B and C.

In case of blister gas casualties the following first-aid is provided immediately:-

- A proper ointment should be applied immediately. If not available the contamination should rubbed off with a handkerchief or a rag.
- The poisoned person or things should be kept away until the cleansing process has been carried out.
- For indirect contamination thorough washing should be done.

In the case of skin burning without blistering, if itching prevails, highly diluted solution of potassium permagnate, saturated solution of sodium bicarbonate, iodine tincture or any suitable evaporating lotion may be used as an immediate remedy. If the blisters develop prominently, they should not be disturbed until appropriate medical treatment is available. As far as the eye damaged casualties are concerned, they should be comforted by the use of eye-shade. Eye treatment requires prompt washing with a warm solution of sodium bicarbonate followed by

instillation of liquid paraffin drops or drops of a dilute solution of argyrol or protargol.[18]

In the case of nose irritation, gargling and douching with any bland solution, spraying with parolein or any antiseptic may be applied.[19] Itching of frequently generated inflammation is relieved by the use of calamine or other alkaline lotions, dusting powder or ointment as prescribed.[20] Blisters should be kept open under antiseptic precaution and the blister liquid should be removed carefully. Dressing of old sterile linen is most useful. Antidote therapy provides positive results against the use of Lewisite. A highly active antidote known as 'unitol' and its interaction with Lewisite gives non-toxic products.

So far as the medical prevention against tear gas is concerned, the eye should be washed with water and after some time an antibiotic ointment should be applied.[21] The casualties caused by sneeze gases should be displaced to a non-polluted atmosphere and very dilute solution of dicain or novocain should be dropped into the eyes. If the casualties feel intense headache, pyramidon or pheneacetin are prescribed in normal doses. In rare cases morphine or pantopon are prescribed.[22]

(b) AGAINST BIOLOGICAL THREAT:

Vaccination is one of the important protective measures against small-pox, yellow fever, diptheria and many other diseases which are very infectious.[23] It is thought, however, that even those vaccines which are effective against natural infectious diseases might provide only limited protection against agents disseminated in the atmosphere in large quantities by a biological weapon. As entire population can not be vaccinated against all possible diseasescaused by biological agents, it is quite obvious that immediate protection should be taken as per requirements.[24]

There are various such vaccines, if they are administered, may cause side-effects to the victims and they may also be immensely expensive. This hazardous spectrum of effects caused by biological agents is now penetrated by certain new advances made in domain of vaccination. There have been reports of numerous current developments in the control of virus diseases but at present non of these is practicable as preventive measure for large numbers of people against biological attack.

Prophylaxis against some disease can also be given by the administration of specific antisera from the blood

of the people or animals previously innoculated with micro-organisms, or products obtained from them, to augment the antibody levels (immunity) in their blood.[25] Tetanus anti-toxin is applied in this way until more efficatious means replaced them, such antisera were applied for numerous diseases.[26] It would, however, be impracticable to prepare specific antisera against all possible bacteriological agents and to facilitate their availability for the entire population.

Other anti-bacteriological agents came into existence, which include the use of immune serum, such as gammaglobulin, sulfonamides and antibiotics.[27] Since gammaglobulin is prepared by segregation from human blood, stock could never be made except for certain cases.[28] Theoretically, the application of antibiotics and other compounds might also be beneficial far smaller units doing functions with especially utmost threat.[29]

(c) MEDICAL AND LIFE SUPPORT EQUIPMENT:

Many armed forces have already faced the prospect of chemical and biological warfare sensibly and taken precautions. Others have not, or various reasons are unable to do so. Yet the prospect remains and precautions have to be taken. For a variety of reasons modern medical technology has yet to cover large areas of the globe.

A few countries of the world have produced medical and life support equipments which are as under:[30]

Polyinject Syringe (France) :

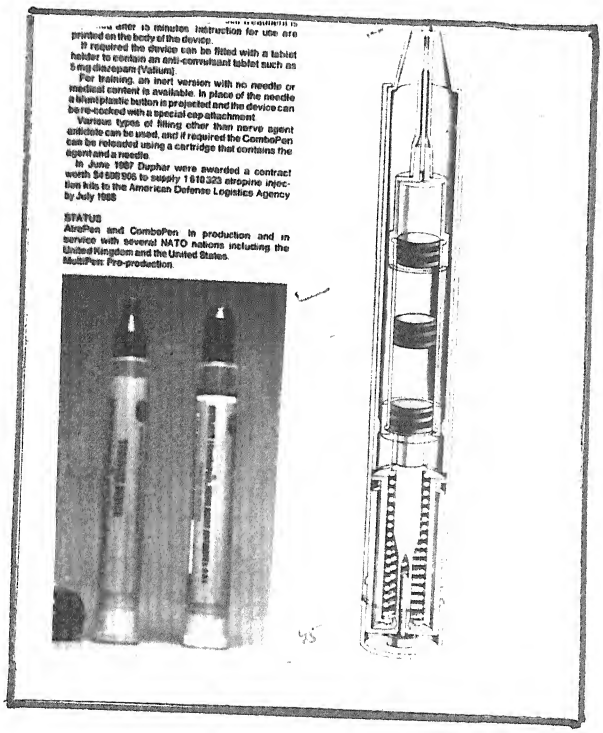
It is a multi-chambered, pressure activated self-injector syringe with the antidote solutions within the main body of the syringe. It can contain up to three different nerve agent antidotes for self administration in one operation.

Protective Kit, Medical, Model MSP-18 (GDR) :

It is meant for self treatment of the effects of chemical and biological warfare and contains several different types of medical drug administrant and an instruction sheet.

Atro Pen, Combo Pen & Multi Pen Nerve Agent Antidotes(Holand):

These all autoinjectors are hypodermic devices meant for self administration to encounter nerve agents. Atropen contains atropine, Combopen contains a solution of water soluble medicaments atropine and oxime while the multipen may contain up to three medicaments stored seperately and makes it possible to combine the water insoluble diazepam with other nerve agent antidotes. All three devices are used in the same manner.



printed on the body of the device.

If required the device can be fitted with a tablet holder to contain an anti-convulsant tablet such as 5 mg diazepam (Valium).

For training, an inert version with no needle or medical content is available. In place of the needle a blunt plastic button is projected and the device can be re-cocked with a special cap attachment.

Various types of filling other than nerve agent antidote can be used, and if required the ComboPen can be reloaded using a cartridge that contains the agent and a needle.

In June 1987 Duphar were awarded a contract worth $4 500 000 to supply 1 618 323 atropine injection kits to the American Defense Logistics Agency by July 1988.

STATUS

AtroPen and ComboPen. In production and in service with several NATO nations including the United Kingdom and the United States.

MultiPen: Pre-production.

ATRO, COMBO AND MULTI PEN
NERVE AGENT ANTIDOTES
(NETHERLANDS)

Duphar Nerve Agent Poisoning Prophylaxis(Holand):

The only efficient and available antidotes against Soman is pyridostigmine given prophylactically and followed by the usual therapy. This drug is available as a 30 mg tablet that should be taken orally three times a day.

Atropine Injector (USSR):

It is a squeeze type hypodermic syringe which contains and dispenses a 1 cc dose of 0.1 percent atropine sulphate solution from a flexible plastic capsule. It is in service with the Soviet and warsaw pact forces.

Vesicant Agent Protective Ointment, M5 (USA):

It is used for protection against blister agents and for neutralising such agents once used. It can also be used for decontaminating personal weapons and equipment.

Pralidoxime Mesylate Tablets (U.K):

It enables personnel to survive what would be several times the lethal dose of the majority of known nerve agents. For use by troops in the field, tablets are issued in one-day packs consisting of four doses to be taken every six hours.

Except these aforesaid medical equipments, a variety

of life support equipments are in the service of different armed forces, such as NBC casualty bag, Head-Wounded protective mask model Sh R, Pneu PAC Ventilator/Resuscitator equipment, Resuscitator Portable Mark 2, Interspiro spiromatic high performance breathing apparatus, Stellar NBC decontamination water purification equipment, PEG-Enzyme therapeutic process, Mask Chemical-biological: headwounded ABC-M 18, M-272 and AN-M2 water testing kit chemical agent etc.

3. DETECTION AND WARNING:

In the event of chemical and biological attack, it is indispensable,to detect the cloud of chemical and biological warfare agents in the air, so that sufficient protection offered by the use of masks and protective clothing might be achieved before it could prove to be disastrous. Particularly, the aim would be to make vigorous endeavours in the cloud upward of the target so that all those down wind could be given sufficient warning.[31] There is also a need for the detection of land contamination with such agents.

In this connection, we should like to take account of the fact that, thanks to the existence of sophisticated analytical methods of substance separation and identification, it is possible to exactly identify highly effective

biological substances upto an order of magnitude of 10^{-12} mg 1^{-1}.

Nowdays, devices and techniques that allow for the detection of even the smallest amounts of chemical-warfare agents are available to many armies and, of course, to toxicological laboratories throughout the world. In most cases identification of poisonous substances is possible by the use of several methods which complement each other and which exclude identification failure to the highest degree of probability.

(a) AGAINST CHEMICAL ATTACK:

In previous wars, the small and colour were the prime means of chemical attack detection. But the newer, more poisonous chemical agents can not be distinguished in the similar circumstances. Once an adversary has launched chemical attack, such subsequent blow would inevitably have to be treated to be hazardous chemical attack and adequate protective means would have to be applied as early as possible.[32] In the case of detection of gas casualties, the first step is to determine promptly who are gassed and who are not, and secondly which group of toxin is concerned.[33]

It has been observed that the poisonous effects of

chemical warfare agents of different groups are reasonably definite. They must be thoroughly studied, fairly understood and cautiously memorised. Generally, the detection and differentiation of gas casualties depends on an observation of one or more of the following considerations:-

- Odour, colour or other symptoms of agents.
- Clinical signs of affected person.
- The patient's own answer.

It would also be necessitated to provide test devices, collectors and analytical laboratory experiments in order to ensure whether the atmosphere is safe as well as to identify properly the specific chemical warfare agent in an attack. The first integral constituent of a defensive system would be the arrangement of an instrument which could detect low concentration of various chemical warfare agents. However low the concentration, individual could inhale a poisonous quantity in a short duration because he breaths 10-20 litres of air perminute.[34] Typical detector kits could be used containing sampling tubes and/or reagent buttons, papers etc. After being exposed to a specific toxic agent these detectors change colour or represent some other alteration easily discernible without any use of special equipment.

Chemical detector kits could also be used to determine

when it is secured to remove protective clothing etc. The USA and the USSR both are increasingly moving to strengthen their defence systems against chemical warfare agents by the introduction and development of electrochemical poison gas detectors.[35] Evidentaly, laboratory examinations, whether mobile or static, can provide more profound analysis of toxic agents than can detection kits.

Warning devices which have been introduced include sensitive detectors that actuate an automatic signal of alarm which warns people to follow protective measures before a lethal dose of the toxic agent is inhaled. They are of two types:-

i. Point sampling devices:

They sample the air at one spot by means of an air pump.

ii. Area scanning devices:

They search into a specific area attacked by the use of chemical warfare agents.

The limitation of point sampling devices is that they must be located upwind of the area that has to be detected against the agent, and a rather large number of these devices may be required. Highly successful area

scanning devices have not yet been developed. But the process of research and development is on.[36]

DETECTION LIMITS OF KNOWN CHEMICAL-WARFARE AGENTS[37]

Chemical agent	Threshold dosage ($mg\ l^{-1}$/ min)	Threshold concentration in $mg\ l^{-1}$ after a time of exposure of:		Required sensitivity of the method ($mg\ l^{-1}$)
		5 min	1 hour	
V-agents	0.00025	0.000025	0.000004	1.10^{-6}
Sarin	0.0025	0.00025	0.00004	1.10^{-5}
Yperite	0.01	0.001	0.0002	1.10^{-4}
Phosgene	0.05	0.005	0.001	1.10^{-3}
Hydrogen cyanide	0.2	0.02	0.005	5.10^{-3}
Cyanogen chloride	0.3	0.03	0.005	5.10^{-3}

(b) AGAINST BIOLOGICAL ATTACKS:

Like chemical agents, the detection of biological warfare agents is not easy from the biological paraphernalia of the evironment by a particular chemical or physical reaction, and much lower aerosol concentrations of biological agents are hazardous than that of chemical warfare

agents. The early detection and warning problem can be solved up to some extent by certain non-specific but very sensitive physical devices, such as particle counters and protein detectors as the protein is a typical part of the micro-organisms.[38] Imaginative evidence of a biological attack might be presumed if there are unusual deviations from the normal amount of materials in the atmosphere noted by the instrument. Such deviations would, however, require deep study and comprehensive analysis of the normal amounts in a given area. In ideal automatic system for early warning against biological catastrophe would consist of the following constituents:[39]

- A device to accumulate huge volumes of air and concentrate the particular material obtained, in a small surface,
- A device to record the amount of the collected material and eventually to identify it,
- A device to analyse the data and results and to initiate warning as early as possible.

Detection of biological warfare agents for issuing warning is highly difficult because of the reason

that this process required usually sufficient time and large and fluctuating amounts of bacteria and other organic materials prevail in the atmosphere at all times. At present, warning devices have been developed

which are sensitive but non-specific and these, unluckily may provide unreliable and false alarms. Vigorous endeavours for research on this significant issue are being made continuously. The some of the techniques that are being applied in this extensive study have been introduced by V.W. Greene in his book named 'Biodetecting and Monitoring Instruments open new Doors for Environmental Understanding'(104-112).

So far as the problem of warning is concerned, it requires a great deal of attention. An aircraft sent to infect the Indian territory would have to fly for approximately some hours at minimum height, at right angles to the wind. It would be a matter of deep concern for the air-defence system to predict each day the flight path suitable to a pathogenespraying aircraft and then to monitor any machines that follow similar track. For this purpose sensitive and specific surveillance equipment should be designed in India or imported in large numbers from advanced countries having them.

(c) WARNING AND DETECTION EQUIPMENT:

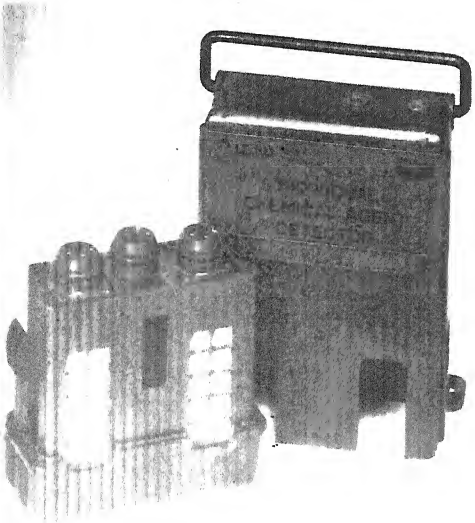
Even though a country might not, a matter of policy, develop chemical and biological weapons, it is imperative that it should direct its energies towards the development of a system to detect and identify such agents when used by

an enemy nation, so that the defence of the country is not jeopardized.

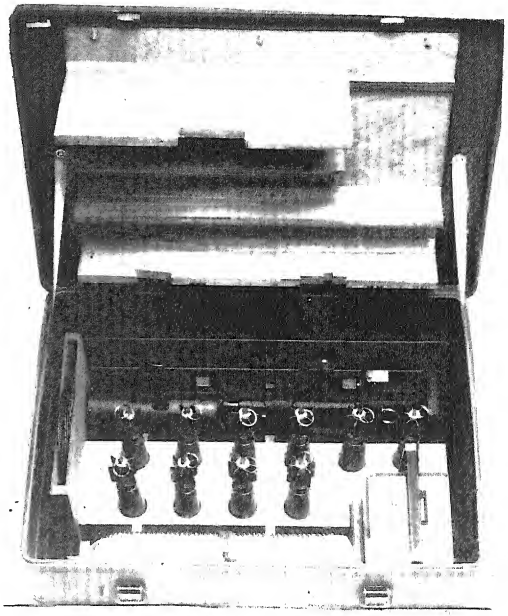
A survey of available literature reveals that it is mostly the chemical agents which are capable of inflicting harm on the civilian and military population. Even in their practical use, as our experiences reveal, the chemical are simple to use and to cause heavy damage. On the other hand biological weapons are liable to effect comparatively lesser damage due to well developed health measures taken by even poor countries. It is in this context that equipments developed are mainly concerned with the detection and identification of chemical warfare agents.

The following enumeration shows the development of various equipments by different countries of the world:[40]

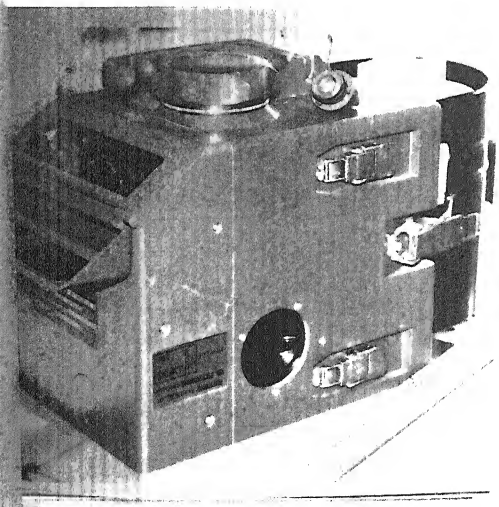
Detector Kit-Chemical Agent(C-2), Chemical Agent Liquid Detector Papers-3-Way(M-8 and M-9), Detector Chemical Agent(Nerve Vapour), Chemical Warfare Agent Identification Kit (M-75), Chemical Warfare Agent Vapour Detector Kit (M-86), Detector Paper Booklet-Chemical Warfare Agent(Liquid), Bruel & Kjaer Toxic-gas Monitor-Type 1306, M86/A-D1 Chemical Agent Detector, PROENGIN Portable Chemical Contamination Monitor (AP2C), Chemical Detection Kit (Model 1 bis), Detalac, Renault VAB Reco NBC Reconnaissance Vehicle, Mobile NBC Laboratory RChLab-11, Detection and Identification Set-



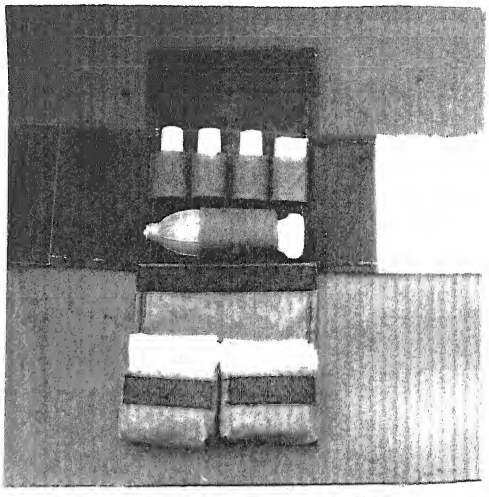
INDIVIDUAL CHEMICAL AGENT DETECTOR(USA)



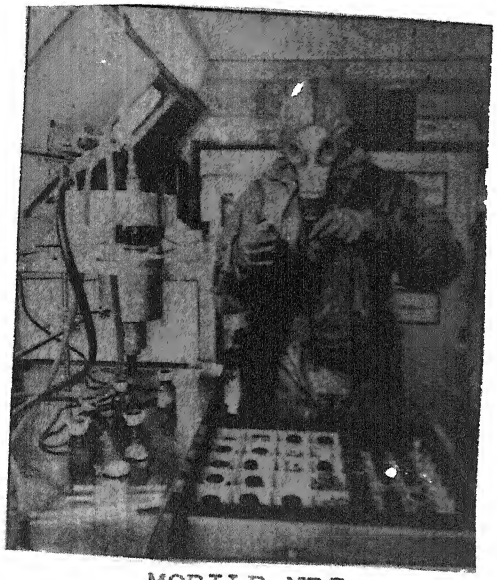
SEMA MT-90 CHEMICAL AGENT DETECTOR(U.K)



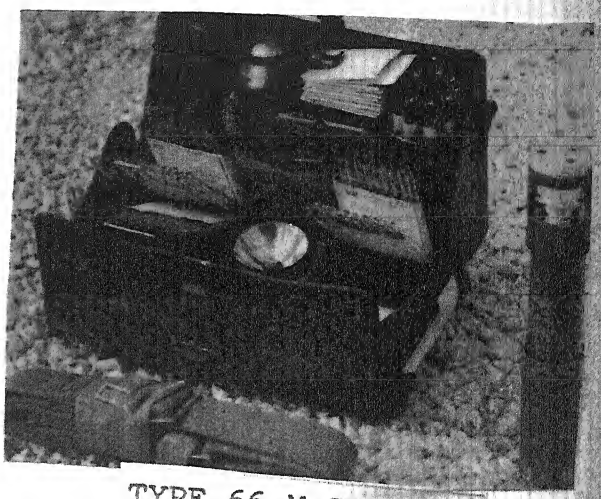
DETALAC MLE F-1(FRANCE)



CW AGENT VAPOUR DETECTOR(CHINA)

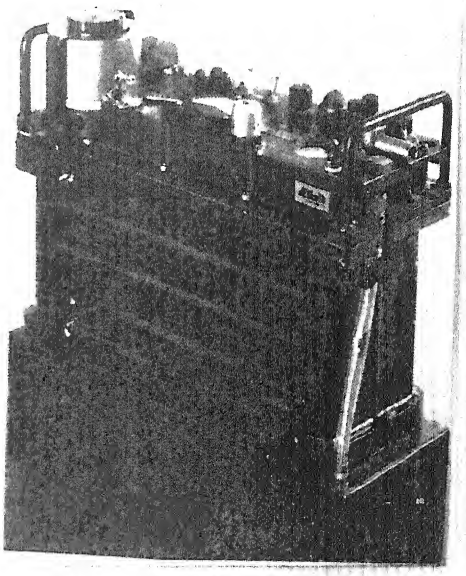


MOBILE NBC
LABORATORY (GDR)



TYPE 66-M CHEMICAL
RECONNAISSANCE SET
(HUNGARY)

MARKING SET, CONTAMINATION:
NBC (GFR)



CHASE CHEMICAL AGENTS
SENSOR (ISRAEL)

Chemical Agent(Models CHNS and CNS-62), Automatic Chemical Agent Indicator GSA-12, MM-1 Mobile Mass Spectrometer, Transportpanzer 1 'Fuchs' NBC Reconnaissance Vehicle, TM170 NBC Reconnaissance Vehicle, Marking Set-Contamination(NBC), Type 66-M Chemical Reconnaissance Set, Type FVJ Chemical Agent Detector, CHASE Chemical Agents Sensor, Odelft ACAL Chemical Agent Detection and Alarm System, Duphar 'The Button' Individual Chemical Detector, Duphar Water Testing Kit-Chemical Agents, Chemical Detection Kit CAD, Medical-veterinary Chemical Agent Detection and Identification Kit (Model PKhR-MV), Chemical Agent Detection and Identification Kit(Model UPI), Automatic Nerve Agent Detector-alarm(Model GSP-11), Field Chemical Laboratory (Model PKhL-54), Biological Warfare Sampling Kit(Model KPO-1), Indicator Powder and Dispenser, Chemical Agent Monitor(CAM), NAIAD, Ship Installed Chemical System (SICS), SEMA MT80 Mark 2 Chemical Agent Detector, SEMA MT90 Chemical Agent Detector, Detector Paper Chemical Agent No2 Liquid, Detector Kit Chemical Agent Residual Vapour No1 Mark 1, XM87 Nuclear-Biological and Chemical Reconnaissance System, Bendix BxICAD Miniature Chemical Agent Detector, XM85/XM86 Automatic Liquid Agent Detector System, Alarm-Chemical Agent-Automatic Portable (M8 and M10 to M18), Detector Kit-Chemical Agent ABC-M18A2, Detector Kit-Chemical Agent-M256, Sampling and Analysing Kit-CB Agent-ABC M19, Sampling Kit-CB Agent-M34, XM21 Remote

Sensing Chemical Agent Alarm, XM22 Automatic Chemical Agent Detector Alarm(ACADA), Hughes Remote Active Spectrometer, Alarm-G Agent-Automatic-Fixed Installation(M5), Paper Chemical Agent Detector(AN-M6A1), PKhR Series of Chemical Agent Detection and Identification Kits, Semi-automatic Chemical Agent Detection and Identification Kit(Model PPKhR and PPChR), Chemical and Radiological Reconnaissance Vehicles and PHD Semi-automatic Chemical Agent Detector etc.

4. DECONTAMINATION:

Decontamination and disinfection are measures which may become necessary after an attack with chemical and biological warfare agents. However, defensive measures will serve no purpose unless a sufficient effective warning system is available.

(a) FOR CHEMICAL AGENTS:

Most of the chemical warfare agents are slowly decomposed by moisture and rain, therefore protracted exposure to weather and sunlight is found to reduce or remove the hazards of these agents. But one could not put utmost reliance on natural degradation to remove the danger, in common terminology, it would be inevitable to follow decontamination. The natural degradation would lessen the degree of danger, but it is a time-consuming

process and largely hamper the normal activities.

Keeping inview that numerous chemicals have been invented which could be used as decontaminants, the decontamination on the particular agent which has to be neutralized or degraded, the type of the surface that necessitates to be treated, the degree of contamination and the availablity of time.[41] The decontamination agents range from soap and detergent in water to caustic soda, various organic solvents, a copious supply of water and suitable equipments.

Decontaminating solutions, powders, applicators and techniques have been evolved for the process of skin, body, clothing, personal equipment and water etc.,but they should essentially be used instantaneously after chemical attack.[42]

The contaminated food should be immediately destroyed other-wise it would contaminate the surroundings which could be very harmful to the host people. Decontamination of complicated equipment and vans is difficult and requires a protracted period.[43] Specially pressurised sprayers to scatter powdered and liquid decontaminants have been developed in order to achieve the object. Various paints and coatings are also in the service of different forces which offer a flat impermeable surface to prevent the penetration

of chemical warfare agents.

Decontamination might even necessitate to be extended to roads and selected areas. This would require the removal of contaminated soil by bulldozing or by covering it with the earth, utilizing explosives to disseminate a powdered decontaminant over a vast areas.[44]

(b) FOR BIOLOGICAL AGENTS:

The methods of decontamination for biological warfare agents are identical to those utilized for chemical warfare agents. Aeration and exposure to strong sun light will eliminate most of the micro-organisms, as will exposure to high temperatures.[45] Fully cooking exposed food and boiling water for a minimum time of 15 minutes will destroy approximately all relevant micro-organisms.

The general principles applicable to decontamination and disinfection in the context of defence and against biological warfare agents attack are those fundamental to general hygiene. They are enumerated below:-

HEAT : Most vegetative bacteria, viruses, parasites and fungi can be destroyed by boiling (100°C) for a period of 10 minutes. In the case of bacterial spores, certain viruses (e.g. Hepatitis virus), and certain toxins

(e.g. Staphylococcus exterotoxin) a boiling time of several hours is necessary. In a situation in which the biological agent has not been identified, destruction of the agent by boiling would be problematical unless boiling can be continued for several hours. Autoclaving would be an alternative, however, many materials can not withstand this process.

FLUID DISINFECTION : These are mostly solutions of germicidal substances and a variety of such disinfectants may be of value, the choice in each case depending upon the situation. (Halogen compounds such as hypochloride or iodine preparation, quaternary amonium compounds, acid such as acetic acid, etc.)

GASEOUS DISINFECTANTS : A number of substances are available the most useful being ethylene oxide, formaldehyde, para-formaldehyde and para-acetic acid.

DISINFECTION BY FILTRATION : The main interest in filtration procedures would be in connection with the sterilisation of drinking water. Units for delivering portable water are in common military use.

It is highly questionable whether decontamination of equipment, buildings etc., is at present a realistic possibility. If it should, however, be judged desirable,

the best method would in most cases be gaseous disinfection with formaldehyde, or simply washing with water, finally with the addition of a fluid disinfectant. Disinfection of clothing could be done according to everyday methods such as boiling, soaking in a chlorine solution or both, provided the fabric can withstand such treatment. In the case of water and food, current peacetime disinfection procedures are satisfactory. In an emergency situation, however, disinfection could be carried out by boiling, in the case of drinking water by addition of small ammount of chlorine.[4-7] With regard to skin disinfection, washing or showering with soap and water is probably all that will be required.[48]

At last, we can conclude that many forces of the world must transfer attention from primary tasks to recuperation after each chemical and biological attack. Decontamination alone requires countless man power and time. Experiences indicate that a single US division would require an average of 30 tons of chemical/biological defensive supplies and equipment everyday in such a combat: protective garments, gas mask filters, detector refill kits, antidotes, decontaminants, and the like. Daily requisitions for 2,00,000 gallons of wash water (a conservative estimate) would be hard to meet, even where streams and workable fire hydrants are plentiful. Demands would far exceed supply in arid climes. Unsalvageable material would

exacerbate the logistical burden.[49]

(c) DECONTAMINATION KITS ANDEQUIPMENT:

The tremendous discoveries in the field of chemical and biological warfare agents are a great menace to the civilians in general and the troops in particular. Therefore, different countries of world including developing ones are trying to device defensive measures by producing various types of decontamination kits and equipment which are likely to be applicable for future wars, enumerated below:[50]

U S S R :

Individual Decontamination Kit-IPP, Individual Decontamination Kit IPP-3, Decontamination Packet(Model DPS), Decontamination Kit-Model PKhS, Personal Weapons Decontamination Kit- Model IDP, Artillery Decontamination Kit- Model ADK, Machine Gun/Mortar Decontamination Kit-Model PM-DK, Decontamination Apparatus-Backpack(Model RDP-3), Decontamination Apparatus-Backpack (Model RDP-4V), Decontamination Kit-Model IDK-1, Decontamination Kit(Model DK-4 and EEA-64), Decontamination System Portable(Model DKV), Decontamination Apparatus-Trailer-mounted(Model DDP), Decontamination Apparatus-Truck-mounted-Model DDA-53-DDA 53A-DDA 53B and DDA 66, Decontamination Apparatus- Truck-mounted (ADM-48D), Decontamination Apparatus-Truck-mounted(Model

TMS-65), Decontamination Apparatus-Truck-mounted(Model ARS-12D and ARS-12U), Decontamination Apparatus-Truck-mounted (Model ARS-14), Decontamination Station(Models AGV-3M and AGW-3M), Decontamination Apparatus-Clothing-Truck-mounted (Models BU-2, BU-3, BU-4 and BU-4M), Dry-decontaminant Spreader-Truck-mounted (Models PDP-53 and PDM).

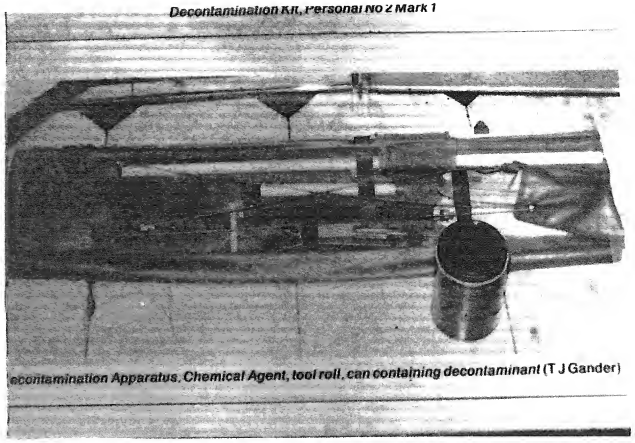
U S A :

Decontaminating and Reimpregnating Kit-Individual ABC-M13, Decontamination Kit- M258A1, Decontaminating Apparatus-Portable-DS2-1$\frac{1}{2}$ quart- ABC M11, M13 Portable Decontamination Apparatus(DAP), Decontaminating Apparatus-Power-driven-Skid-mounted: Multi-purpose-Non integral 500 gallon- ABC M12A1, M17 Lightweight Decontamination System-Sanator, XM18 Truck-mounted Decontamination Apparatus.

G D R (Germany Democratic Republic):

Individual Decontamination Kit(Model EP-60), Individual Decontamination Kit(Model EP-62), Large Decontamination Kit(Model GES-10), Decontamination Apparatus Backpack(Model TEG-57 and TEG-57A), Decontamination and Deactivation Apparatus(Model EEA-61), Decontamination Apparatus-Truck-mounted(Model GEW-1), Decontamination Apparatus-Truck-mounted(Model GEW-2), Decontamination Apparatus-Truck-mounted(Model GEW-3), Decontamination

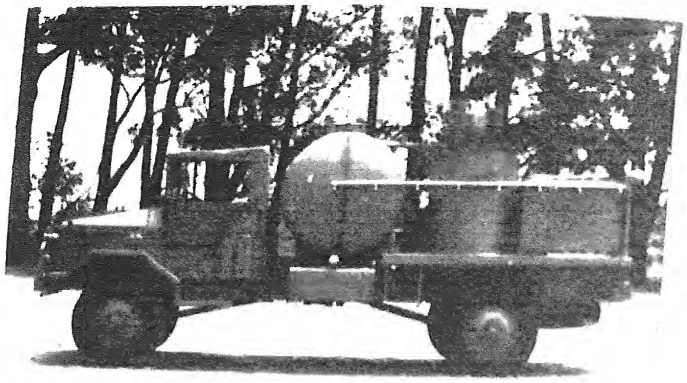
DECONTAMINATION KIT
MODEL PM-DK(USSR)



DECONTAMINATION
APPARATUS CW AGENT(U.K)

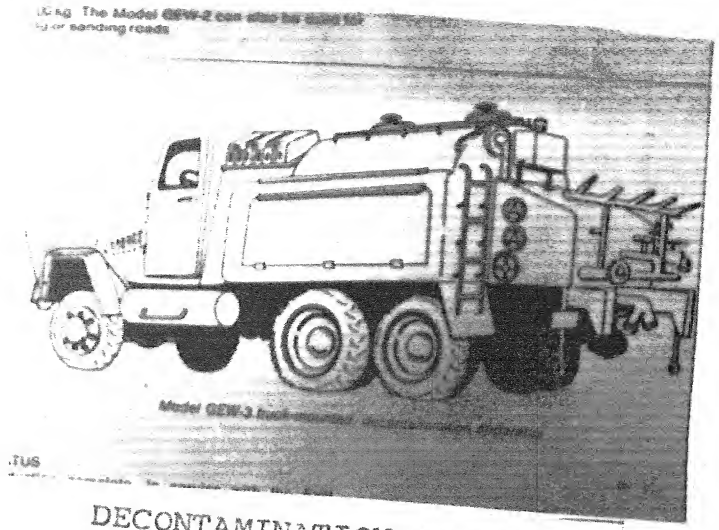
M-82 PERSONNEL SHOWER
VEHICLE(CHINA)

NGL DECONTAMINATION
& SCREENING SYSTEM(U.K)



ENGESAEE-25 NBC
DECONTAMINATION TRUCK(BRAZIL)

NBC DECONTAMINATION
VEHICLE(YUGOSLAVIA)



DECONTAMINATION APPARATUS,
TRUCK-MOUNTED,MODEL GEW-3
(GDR)

VT/Germany (Federal)

OWR DEKON DECONTAMINATION
SYSTEM(GFR)

Apparatus(Model EA 65), Decontamination Apparatus-Truck-mounted(Model MOE), Decontamination Shower Apparatus-Vehicle-mounted(Model DA-2S), Decontamination Shower Apparatus-Truck-mounted(Model DA-66), Decontamination Apparatus-Truck-mounted-Model EW-1 Decontamination Apparatus Skid-mounted(Model S-4), Decontamination Apparatus-Truck-mounted-Model EW 2- Decontamination Apparatus-Skid-mounted (Model S-6), Decontamination Pumping Apparatus-Trailer-mounted(Model TS-8)etc.

U K :

Decontamination Kit-Personal No 1 Mark 1, Decontamination Kit-Personal No 2 Mark 1, Decontamination Apparatus-Chemical Agent, NGL Dual Purpose Decontamination and Large Area Screening System, etc.

CHINA :

M-73-1 Decontamination Vehicle, M-82 Personnel Shower Vehicle, Decontaminating Apparatus-Tank M-84, etc.

ITALY :

Cristanini Sanijet C 921 Decontamination System, Cristanini Sanijet 3000/3 Containerised Decontamination System, Tirrena Chemical Decontamination Equipment, etc.

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CHAPTER - V

INTERNATIONAL - POLICY

REGARDING

CHEMICAL AND BIOLOGICAL WEAPONS

INTERNATIONAL POLICY

The growing destructive trend of the chemical and biological researches, having its powerful impact on Military Science is posing a serious threat to the ultimate survival of the human race. Now chemical and biological weapons hold a big place in the arsenals of modern means of mass destruction. In some respect they may be even more dangerous than nuclear weapons because they do not require the enormous expenditure of financial and scientific resources that are required for nuclear weapons. Most of the countries, including small ones and developing ones, may have access to these weapons which can be manufactured quite cheaply, quickly and secretly in small laboratories and factories. This fact in itself makes the problem of control and inspection much more difficult.[1]

Since the Hague peace conference of 1899 and till the present day different states have made efforts to limit the use of such weapons by imposing international law in this direction. The use of toxic substances was foreseen at the Hague peace conference of 1899.[2] The signatories, including Germany had pledged among other things "to abstain" from the use of projectiles the object of which was the diffusion of asphyxiating or deleterious gases.[3] The United States representative opposed the resolution

because:

- The United States did not wish to deny itself prematurely a means of defence,
- It was doubtful, whether an international agreement would overcome the temptations of a nation for such use,
- The resolution was premature because the real effects of such weapons were unknown.

However, the resolution was passed without further resistance. Twenty six states signed the resolution, the United States and the United Kingdom were the only major powers who did not sign it. Further, at the Hague convention of 1907[4] the following rule was adopted:

It was expressly forbidden

- To employ poison or poisoned arms,
- To employ arms etc., of a nature to cause unnecessary sufferings.

At this convention British delegate accepted the declaration of 1899 and several Latin American Republics did the same. The United States still did not agree with the resolution. It was argued that toxic gases were not contemplated as coming with in the scope of this clause,

but this interpretation was not acceptable to most of the powers.

Yet, despite its widespread development and use in the years following the first world war, gas warfare was still technically illegal. The allied powers described it as a "prohibited" form of warfare at versailles in 1919 and banned the importation and manufacture of poison gas in Germany for all times. They assumed that their use in any form was contrary to international law.[5]

Three years later, the washington conference went even further. At the conclusion of this conference of 1921-22, the United States, France, Italy, Great Britain and Japan framed a treaty containing following provisions:

> "The use in war of asphyxiating, poisonous or other gases and all analogous liquids, material or devices, having been justly condemned by the general opinion of the civilized world and a prohibition of such use having been declared in treaty to which a majority of the powers are parties." The "Civilized powers" decreed that the banning of chemical warfare should "be universally accepted as a part of international law binding alike to the conscience and practice of nations".[6]

At this time, this international policy provision had three important aims to fulfil:

- To obtain acceptance by the United States for the prohibition of chemical warfare,
- To improve the extension of such prohibition over the narrow description continued in Hague conference,
- To reaffirm the validity of the existing law with respect to the use of noxious gases.

On 7th Feb.,1923, the Central American Republics signed a convention which declared that the asphyxiating gases, poison or similar substances were contrary to international law and humanitarian principles. This convention although of regional application only, was indicative of general attitude concerning poisonous gases which prevailed during the years following the first world war.

The international community viewed with horror the advances made in the sphere of chemical and biological methods of warfare because of their uncontrollably and unpredictably injurious effect to combatants and non-combatants alike. Finally, in May 1925, under the auspices of the League of Nations, a conference on international arms trade was convened in Geneva, led by the United States. The

delegates agreed to try and tackle the problem of poisonous gases, 'With', as the American put it, the hope of reducing the barbarity of modern warfare. After a month of wrangling in legal and military committees during which the Polish delegation far-sightedly suggested that they also ban the use of germ weapons, then little more than a theory- the delegates came together on 17 June to sign what remains to this day the strongest legal constraint on chemical and biological warfare.[7] Thus the Geneva protocol of 1925 prohibits the use in war of "asphyxiating, poisonous or other gases, and all analogous materials, liquids or devices", as well as "the bacteriological methods of war".[8]

Thirty eight powers signed the Geneva protocol, among them the United States, the British Empire, France, Germany, Italy, Japan, the fledgling USSR did not attend. At the end, the signatories declared: That the high contracting parties, so far as they are not already parties to treaties prohibiting such use accept this prohibition, agree to extend this prohibition to the use of bacteriological methods of warfare and agree to be bound as between themselves according to the terms of this declaration. 'The signing of the Geneva protocol of 1925, as one expert has put it", was the high-water mark of the hostility of public opinion towards chemical warfare".[9] Merely signing

the protocol was not enough to make it binding- individual governments had to ratify it. In many cases this meant a time lag of at least a year, and it was in this period that the supporters of chemical weapons struck back.

The United States chemical warfare service launched a highly effective lobby. They enlisted the support of veterans associations and of the American chemical society whose executive declared that the prohibition of chemical warfare meant the abandonment of humane methods for the old horrors of battle. As has often happened since, the fight for chemical weapons was represented as a fight for general military preparedness. Senators joined the chemical warfare services campaign, among them the chairman of the committee on military affairs who opened his attack on ratification in the senate debate with a reference to the 1922 washington treaty: I think it is fair to say that in 1922 there was much of hysteria and much of misinformation concerning chemical warfare. Other senators rose to speak approvingly of resolutions which they had received attacking the Geneva protocol from the associations of military surgeons, the American legion, the veterans of foreign wars of the United States and the military order of the world war. Under such heavy fire, the state department saw no alternative but to withdraw the protocol. Japan followed

America's example and refused to ratify.

In Europe the various nations eyed one another cautiously. France ratified first, in 1926. Two years later, in 1928, Italy followed suit and a fortnight after her, the Soviet Union declared that she, too, considered herself bound by the protocol. Only after Germany ratified in 1929 did Britain feel able at last to accept the protocol: On 9 April 1930, five years after the conference, Britain at last fell into the line. Many of the states which ratified the protocol including France, Great Britain and the Soviet did so only after adding two significant reservations:

- That the agreement would,not be considered binding unless the country they were fighting had also ratified the protocol;

- That if any other country attacked them using chemical or biological weapons, they reserved the right to reply in kind.

Justly condemned by the general opinion of the civilized world chemical weapons might be; abandoned they certainly were not. The Geneva protocol was, effectively, a ban only on the first use of poison gas or germs. There was certainly no ban on researching and stockpiling of these weapons and contains no provisions for ensuring verification

or for dealing with compliance issues.[10] The commitment by most of the world's governments never to initiate the use of poison gas did not stop research: it simply made the whole subject that much more sensitive, and thus more secret.

Since the adoption of the protocol, there have been many scientific and technical developments in the field of such weapons which have created new situation and new problems. On one hand there has been a great increase in the capability of these weapons to inflict unimaginable suffering, disease, death to larger number of human beings, on the otherhand, there has been a growing tendency to use some chemical agents for civilian riots control and a dangerous trend to accept their use in some form in conventional warfare.[11]

During the discussion on the question of chemical and biological warfare weapons the controversy arose regarding the distinction between tear gases and poison gases or lethal or non-lethal chemical agents. In this connection, it was made clear that the prohibition contained in Geneva protocol applies to the bacteriological agents, including tear gas and other harassing agents which now exist or which may be developed in near future.

France and Britain, the parties to the Geneva protocol, accepted the recommendation of the special committee of 1932 which defined prohibition as to "encompass all substances which are capable in any way of producing harmful effects on human or animal organism, whatever the method of their use". The United States, which was not party to the Geneva protocol, expressed the view that "while the use of tear gas for local purposes should be allowed, the US agreed, that its use in war should be prohibited".[12] Because such agents are used by civil authorities of a number of countries in order to suppress disorders and to control riots, but when used in warfare they would inevitably be employed as an adjunct to other forms of attack and their overall effect might be lethal.[13]

During the first world war attempts to employ chemical weapons and barbarous nature was immediately obvious. This truth has been repeatedly confirmed in subsequent years in the course of second world war, when Germans in some cases resorted to the use of chemical and bacteriological means, and specially during the war in Vietnam which has furnished examples of the most wide-spread and systematic use of chemical weapons by the United States armed forces. As a direct result of all such circumstances,

the 24th session of UN General Assembly discussed and approved a report "Chemical and bacteriological weapons and the effects of their possible use".[14] The outstanding point in the report is as follows:

> "Their large scale use could conceivably have deliterious and irreversable effects on the balance of nature".[15]

In this session of UN General Assembly a resolution was passed on prohibition of the chemical and biological weapons, welcomed the report and recommended all governments to circulate this document widely in order to acquaint the public with its contents, and invited all the states to accede or ratify the Geneva protocol.

On January,1946, most of the members of United Nations made a pledge at the first session of General Assembly to eliminate all weapons of mass destruction. Because they realized that there was urgent need to take step for outlawing it. So different countries including India supported General Assembly resolution 715(viii), which called "for elimination and prohibition of atomic, hydrogen, bacterial, chemical and all such weapons, of war and mass destruction."

Similar view was adopted in the General Assembly

of UNO on 28 September,1953, over the development of napalm bomb and various other weapons and inventions by which human beings are gradually tortured and are burned to death.

Current efforts within the international community to strengthen and extend the chemical and biological arms control regime were initiated in the late 1950. They gained encouragement from that sequence of events which caused the United Nations disarmament-machinery to begin an active quest for "collateral measures" of disarmament alongside its then-continuing efforts aimed at general and complete.[16] In 1960 the Soviet Union submitted to the 15th session of the United Nations General Assembly a document on the 'main principles of an agreement on general and complete disarmament.' This proposal provided for carrying out disarmament under strict international control. Unfortunately, a debate on these Soviet proposals did not take place because they were rejected by some western states.

In a memorandum submitted to the United Nations General Assembly on 15 September 1960, the Government of the German Democratic Republic recommended the implementation of a comprehensive, phased disarmament programme with agreed time-frames. The first phase covering the year 1960 and 1961 provided that: The two German States under-

take not to produce chemical and biological weapons or take part in their production in other countries or acquire or retain such weapons, as well as participate in testing such weapons on the territories of other states. In addition, this memorandum included a mutually acceptable proposal concerning for reaching control measures: For the purpose of controlling the prosecution of the proposed measures a control agency will be set up composed in equal members of representatives of the "Volkskammer" of the German Democratic Republic and the West German "Bundestag" as well as of representatives of the trade-Unions and other public organizations-youth, women's and others.

In 1961 the United States and the Soviet Union submitted a "Joint Statement"[17] which included a programme for general and complete disarmament. It contained provisions for the elimination of all stockpiles of nuclear, chemical, bacteriological and other weapons of mass destruction and the cessation of the production of such weapons. The elimination of all means of delivery of such weapons was also included. On 28 March 1962 the 'revised' Rapacki plan was proposed to the eighteen-nation disarmament committee on disarmament. It provided for reducing the stocks of nuclear weapons and means of their delivery as well as for a two-phase reduction of the armed forces and conventional armaments with in a zone of central Europe.

In accordance with this plan, an organ of control was to be set-up and invested with mutually agreed-upon powers and structure. The signatory states were to determine the scope and means of control.

Further impetus came from the use of such weapons during the yemeni civil war and Vietnam. In 1968 the subject entered the agenda of the multi-lateral disarmament negotiating body in Geneva, where it has been ever since. In 1969, Nixon's decision to call halt to the chemical and biological arms race had been prompted by a number of motives. United States deemphasized chemical warfare during the 1970 s, due to public opposition and the absence of proponents. Chemical warfare doctrine, plans, education and training suffered from disregard. Research, development and production bases lay idle or disappeared.[18]

There was wide-spread opposition to the use in Vietnam of weapons which, whatever the state department might claim, certainly looked like gas. And there were a number of highly embrassing accidents. Agreed nations with the Geneva protocol 1925, condemned all such actions contrary to the objective of protocol. In keeping with the validity of the protocol, various nations wanted the whole subject of this category of weapons to be carried a step further but not at the cost of protocol. It was anxious

that there should be no slackening of the efforts to secure wider acceptance of protocol. Besides attaching an element of sanctity to the protocol, different nations including India widened its scope. Today, there are 103 signatories to the Geneva protocol.[18A]

In September 1969, the Soviet along with other socialist countries, submitted to the 24th session of United Nations General Assembly a draft convention on the prohibition of the development, production and stockpiling of chemical and bacteriological weapons. In October 1970, a revised draft convention was submitted to the 25th session of the General Assembly, which indicated concrete ways for saving mankind from these means of mass destruction. The draft provides for the prohibition of both the production and storaging of these weapons. In other words, it was proposed for the complete prohibition of chemical and bacteriological weapons.[19]

In practice two forms of prohibition of weapons are usually differentiated-complete and partial. Partial prohibition means a ban on the use of a weapon. An example is furnished by the Geneva protocol itself. Complete prohibition is a much wider concept. It implies not only prohibition of the use of type of weapons concerned but also the destruction of all weapons of that type in existence. Therefore,

complete prohibition could and should be appropriately applied to such deadly means of warfare as chemical and bacteriological weapons. Today it is important to ensure that the matter should not be limited only to the prohibition of the use of such weapons. The time has come when their production must be stopped and the existing weapons destroyed. This is the only way to deliver mankind from the fear that they may be used.[20]

In 1971, a convention on the prohibition of the development, production and stockpiling of bacteriological and toxin weapons on their destruction was approved by the 26th session of UN General Assembly. The convention formulated the duty of the states not to develop, produce, stockpile, acquire and storage biological agents and toxin and also weapons, equipment and vehicles designated for the delivery of such agents or toxins. The parties to the convention undertook to destroy, or switch over to peaceful purposes. At the same time the convention clearly confirmed in article VIII, the duties which follow from Geneva protocol for the prohibition of the use of chemical and biological weapons. Thus, in no way belittles the role of Geneva protocol but serves as continuation, envisaging the abolition of one type of weapons covered by the protocol. This convention laid the ground-work for the talks which resulted in the elaboration of a convention. Opened for signing in

Moscow, washington, and London on April 10, 1972, it came into force in 1975.[21]

The 1972 biological weapons convention, to which the United States and Soviet Union were also parties baned the development, production, stockpiling or possession and transfer of biological agents or toxin except for small quantities for peaceful purposes.[22] This convention provides for verification through a compliance and consultation procedure generally. Considered symbolic at best. However, any party may withdraw from the convention with six months notice. Efforts to secure a similar treaty prohibiting chemical warfare have been going on since 1968, but have constantly foundered on the problem of verification and inspection. Moreover, the biological weapons convention carries no provision for either and is effectively a gentlemen's agreement.

On the pattern of the convention on biological weapons in March 1972, a draft convention on the prohibition of the development, production of chemical weapons was submitted to the committee on disarmament. It envisages the complete abolition of chemical weapons. The urgency of the task of creating real guarantees so that chemical and bacteriological weapons should no longer endanger mankind is clearer today than ever before. When the international

legal method of complete prohibition is applied to both these means of mass destruction, this will ensure their elimination from the life of mankind.

During the proposed convention there was no unanimity whether both the weapons- chemical and biological should be dealt in one convention or two conventions, if in two conventions, whether separately or simultaneously; or with biological weapons now and chemical weapons later. It was the firm view of India that both types of weapons should be dealt with together or simultaneously. Since 1926 both have been dealt together in international agreements and so also in the respective drafts of a treaty on general and complete disarmament submitted by the United States and Soviet Union. If bacteriological weapons are to be dealt with now and chemical weapons left for a later consideration because of the difference of the opinion over the definition of chemical weapons arms race and would seem to legitimise it.[23]

Moreover the separate treatment of chemical and biological weapons would lead to the weakening of the protocol because it would appear that protocol was deficient and only partially valid. It would be more difficult to justify the world opinion why biological weapons, which have never been used against mankind should be dealt with

first and chemical weapons, which have been used several times with disastrous results should be dealt with later a some future date.

Despite president Nixon's promise to "destroy existing stocks of biological weapons" and his assurance about dismantling biological warfare facilities, the United States continued to work on such weapons. And since Nixon first disallowed the use of these weapons, within three years, the United States stocks have nearly doubled. Contrary to the impression given by the White House, it is stated that USA has not dismantled its germ-producing hardware and still maintains stockpiles of 100 trillion nerve gas doses around the world.[24] The US had also accused the Soviet Union of violating both the agreements by maintaining an offensive biological warfare programme and using toxins and other lethal warefare agents in Laos, Kampuchea and Afghanistan.[25]

Thus even such peacemeal progress is ineffective in face of the continued experiments. These weapons stand in the class of their own as armaments which exercise their effects solely on living matter. Were the weapons ever to be used on a large scale in war, no one can predict how enduring the effect would be and how they would affect the structure of society and the environment in which we live?

The draft convention, providing for a total ban of all chemical warfare agents, submitted by the Soviet Union and third world countries, has been under consideration in the disarmament committee since 1972. This document reflects the basic principled stand on this issue. During 1974 Soviet American summit in Moscow, an agreement was reached that the two countries would consider the question of advancing a joint initiative in the Disarmament committee for signing an international convention concerning the most dangerous, lethal chemical warfare agents.[25A]

In the year 1976, the US and the USSR anounced their intention of starting bilateral negotiation for reaching agreement on effective measures for the prohibition of the development, production and stockpiling of all chemical weapons and for their destruction. In its 1978 special session on disarmament, the United Nations General Assembly also emphasized this matter. As a result of the anxiety of the General Assembly over the issue of such weapons, members of the committee on disarmament urged the USA and USSR to inform about the points on which they had reached the agreement. In response, they reported to the committee in July 1979 about the progress in their bilateral talks.[26]

The Soviet-American talks, underway since 1976, have been certain progress on a number of issues. However, in

1980 the USA suspended these talks and since then has repeatedly rejected some basic proposals to resume them. The obstructionist position of USA and its allies has slowed down the pace of discussion of main issue relating to the prohibition of chemical weapons in the disarmament committee as well.

In the meantime, various lesser objectives have been mooted elsewhere within the international community. One, contained in proposals put before the second special session devoted to disarmament of the UN General Assembly in 1982, has been the idea of supplementing the 1925 Geneva protocol with compliance-verification machinery. Another has been the idea of regional measures of chemical weapons disarmament. A third has been the suggestion of a chemical weapons non-proliferation treaty.[27] This document takes into account the results of the Soviet-American talks and the stand of other states on various aspects of the problem, including verification, the most complicated of them. The document covers all aspects of the problem of banning chemical weapons.

The Soviet Union's position is unambiguous. It has been consistently in favour of prohibition of chemical weapons, and the reduction of existing stockpiles. But it has objection to international verification measures,

including on-site inspection to check compliance with the convention.

For many years, discussions and, to certain extent, negotiations on a convention on chemical weapons have been, and continue to be, conducted at UN conference on disarmament and its preceding bodies. In 10 August 1982, the two committees on disarmament took place and considered about the verification of the presence of nerve agents, their decomposition products or starting materials down stream of chemical production plants. The time-scale alone indicates that this is, indeed, a very difficult problem.[28] Like above, in 1983, United Kingdom and Northern Ireland made proposals for verification of non-production of chemical weapons including monitoring by routine random inspection of certain sectors of the civil chemical industry inorder to ensure that it was not used as a source of agents for chemical warfare. Attention was focused on a list of key precursors for chemical weapons.[29]

Within the United Nations forty-nations-committee on disarmament, the United States has historically pushed for verifiable prohibition on chemical weapons production, stockpiling and transfer, has rejected Soviet suggestion for verification by national technical means(NTM) alone as equivalent to self-inspection, and has stated the absolute

need for oh-site insepction.[30] It was also pointed out that the secrecy is the inherent problem because research and development could not be effectively controlled without openness. If the verification problem can be overcome, a mutual agreement to reduce military research and development budget may be considered.[31]

Discussions concerning a ban on the chemical warfare in the committee on disarmament, mostly remained on the question of Control and Verification method. The developing countries including India called for a combination of national and international means of verification. The debate on this subject, in the opinion of Soviet Union and United States involved many technical as well as political issues.

The deadlock at the talks on prohibition of the such weapons of mass destruction has been due to political considerations rather than technical reasons, i.e., difficulties in coming to an agreement between Soviet Union and USA due to their global interest. The western bloc's stand on this issue was somewhat rigid. Having experience of using war gases in Vietnam, certain influential quarters in USA are clearly unwilling to have these weapons banned and are doing their utmost to start a new round of arms race- this time in the field of chemical weapons.

Grounds for optimism perhaps exist in the reference

to chemical weapons contained in the communique of 21 November 1985 from the Regan-Gorbachev meeting in Geneva. The two sides 'agreed to accelerate efforts to convene an effective and verifiable international convention on this matter, and they intensify bilateral discussions on the level of experts on all aspects of such chemical weapons ban, including the verification!'[32]

1985 brought the 60th anniversary of Geneva protocol, occasion for much reaffirmation of its principles by governments and much exhortatory comment from the arms control community. It also brought new notifications of accession to the treaty, those of Bolivia and Peru. But there was no further movement towards those 'provisional procedures to uphold the authority' of the protocol. The question of procedures for verifying allegations of use was now being considered solely with in the frame-work of the chemical weapons convention negotiations, although on 4 December 1985, the Canadian government presented to the United Nations Secretary General a handbook for the investigation of allegations of the use of chemical or biological weapons. This manual[33] had resulted from a co-operative study involving the department of external affairs and the University of Saskatchewan.

In 1986, negotiation on a convention prohibiting the

development, production and stockpiling of chemical weapons, and providing for their destruction, continued in the committee on disarmament as a priority item on its agenda. These multilateral talks were stimulated by several rounds of complimentary bilateral United States-Soviet discussions. As a result, there is now agreement on the general scope of the envisaged treaty, and a step forward has been made with regard to verification of compliance, as well as in establishing distinct categories of agents and other chemicals of importance that are subject to prohibition or restrictions.[34] But the draft treaty which was intended to incorporate the ban remained in rudimentary form. Thus it failed to reach agreement on any of the items on its agenda. This failure was due to lack of efforts on the part of the international community. On the contrary, the discussions of arms control issues in multilateral forums, within and outside the United Nations, and at both the political and technical levels, have rarely been as lively as they were in the past few years. It was rather the continuous impass in the bilateral talks between the United States and Soviet Union and the generally tense international political climate that hindered the committee on disarmament from moving ahead.

The time was pressing. Allegations continued to be

made against massive production and storage of chemical weapons by the Soviet Union. The United States was ready to begin manufacture of modern binary chemical weapons. France has openly stated that it could not renounce chemical weapons and would have to possess an 'appropriate' deterrent capacity as long as others possessed one.[35] A chemical disarmament convention was ripe for conclusion, and it would be a pity to make it dependent on other arms control measures.

The first review conference of the parties, mandated by article XII of the convention, was held in 1980 to ensure that the contracted obligations were being realized. The second review conference took place on 8-26 November 1986, with 63 of more than 100 states parties including China, France, United Kingdom, United States and the Soviet Union and 4 signatory states Egypt, Iraq, Morocco and Sri Lanka participating.[36] It was expected that convention would clarify uncertainties regarding the scope of the prohibitions, which was arisen as a result of recent advances in the biological field, and restore confidence in this important international instrument, which had seriously shaken by allegations of non-conpliance.

In this convention most of the countries declared, their strong determination, for the sake of all mankind, to

exclude completely the possibility of microbial or other biological agents, or toxin being used as weapons and reaffirmed their strong support for the convention, their continued dedication to its principles and objectives and their legal obligation under international law to implement and strictly comply with its provisions. The parties also agreed to convene a third review of the biological weapons convention not later than 1991.

In 1987, a series of important obstacles which had stood in the way of a comprehensive ban on chemical weapons were removed. In particular, the Soviet Union has accepted the principles of mandatory, i.e., non-refusable, on-site inspection on challenge, which can be set in motion, on very short notice, upon request by any state party suspecting a violation.[37] It has thus acceded to the view held by the United States since 1984.[38] As a result, the positions of the principal negotiating parties in the politically sensitive field of verification of compliance are now closer than ever before.

Moreover, the Soviet Union, which earlier had not even admitted to possessing chemical weapons, indicated the amount of toxic substances it had stockpiled. It also declared that it did not have chemical weapons outside its borders and that it had begun the construction of a special

facility for the destruction of chemical weapons stocks.[39] These statements coupled with international visits to United States and Soviet chemical weapon storage facilities,[40] have helped to build a significant measure of confidence in the seriousness of the super powers intent to be rid of chemical weapons.

There are still many problems that remain to be solved before a convention effectively prohibiting the possession of chemical weapons can be signed. However, the number of controversial political issues relating to the convention has diminished. Chemical disarmament is now the most promising item on the agenda of the multilateral arms control negotiations, the treaty is no longer a distant goal but a real possibility.[41]

The committee on disarmament faces the task of transforming this possibility into reality. The task is urgent, because at least two great powers, the United States and France, have started or about to start the production of new system of chemical weapons, and because the continued use of chemical weapons by Iraq against Iranian combatants and civilians,[42] as well as recently revealed manufacture of such weapons by Iran,[43] have demonstrated the danger of proliferation of these weapons in the third world. Pakistan, too, has occasionally been rumoured to possess chemical

warfare weapons.[44]

During 1988-89, a number of committees on disarmament took place, but the meeting between the United States and Soviet Union in the end of September 1989 was a great success towards this direction. They signed seven protocols covering the wide range of the subjects. The agreement on strategic weapons was the highlight of the meeting. It was announced that a summit meeting between Gorbachev and Bush would take place either at the end of the year or early next year. World expressed satisfaction over the outcome of the talks.

At his meeting of 26 September 1989, the United States handed over to Soviet Union its proposal on chemical weapons. A couple of days later, while addressing the opening session of the United Nations General Assembly, the President Bush presented his plan. He offered to destroy in eight years 80% of the stockpile of chemical weapons without waiting for the conclusion of an international agreement provided the Soviet Union agreed to do same. And once all nations capable of building chemical weapons signed a total ban treaty, the United States offered to destroy 98% of its weapons. The remaining 2% of these weapons would be destroyed in the next two years. He also expressed his willingness to begin the destruction of these weapons at once if the Soviet agreed to join in cutting chemical weapons to an

equal level and there was an agreement on "conditions including inspection under which stockpiles are to be destroyed".[45] The Soviet Union welcomed the American proposal and went to add the Moscow was ready together with the United States and assumed responsibility even before the global treaty was signed and that its government was ready to renounce the use of chemical weapons under "any circumstances".[46]

Although it may take some time to abolish the chemical weapons altogether, with both the super most powers reaching an agreement there is hope that the goal will be achieved. The Bush proposal does not cover the binary chemical weapons which are equally lethal and effective. Therefore, under the proposed agreement, the super-powers may continue for some time with the manufacture of binary weapons. Hopefully this problem would also be resolved soon.

The cause of chemical disarmament would be considerably enhanced if all states clearly stated, even before the convention is concluded, whether they possess such weapon production facilities or not and if those which do possess such weapons provided information regarding the amount as well as the assortment and possibly ceased their production.[47] Strict export controls, introduced as quickly as possible, on those chemical substances which could

be used in making chemical weapons would also be very helpful. Above all, states must become convinced that a world free of such weapons will be safer one. Consequently, a resolute response from the international community is called for to the established facts of use of chemical weapons in violation of the Geneva protocol, whatever the identity of violator.

Success of the present multilateral negotiations regarding the weapons of mass destruction depends in the first place on the determination of the super-powers definitively to renounce chemical-biological warfare and to dispose of their arsenals, the largest in the world. Verification is no longer an insurmountable obstacle. But even with good will on the part of the main protagonists, as well as of the other negotiators, a long time may be needed to settle the controversies still outstanding and to workout the missing provisions of the convention. Moreover, the 'rolling text' now before the committee on disarmament must be transposed into proper trealy language, the redundancies must be removed and the terminology streamlined.

The inevitably lengthy drafting process could be shortened if the elaboration of certain technical details were left to the organs to be created by the convention

rather than attempting to make them final in the body of the convention itself. It is important to foresee all eventualities before the convention starts operating. In any event, a periodic review of the operation of the convention will certainly be provided for, as it has been in several other arms control agreements.

The arms control road to security and disarmament often seems an endless journey, but it has to be undertaken with United efforts and strong determination. Nothing substantial has been achieved sofar except generating common feelings against the use of these deadly weapons and its casual reflection. On looking to the future of arms control or in framing a considered policy on chemical and biological warfare, we have to first ascertain what has already been attained and also ensure that it is available as a solid basis on which to build further.

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CHAPTER - VI

:: INDIA'S POLICY ::

- General Policy.

- Policy on Chemical & Biological Warfare.

INDIA'S POLICY

Mankind is today at a turning point of its history. In this scientific age, the Choice before mankind is survival or total extinction. Peace has become a life and death question. The dread of chemical and biological holocaust haunts us all the time. The stockpiles of deadly weapons are enough to wipe out human species many times over, destroying the civilization built over thousands of years. Naturally prevention of war and preservation of peace is today the supreme issue before mankind. That is why all our actions and efforts have to be directed towards ensuring peace. This fight for peace, for survival of mankind, cuts across all political, religious,.ideological and all other barriers.

Development, independence, peace and disarmament are closely related. Can there be peace alongwith weapons of mass destruction? Without peace said Mrs. Indira Gandhi, all our dreams of development turn to ashes.[1] In Pt. Nehru's opinion[2] "Mankind has to awaken itself to reality and face the situation with determination and assert itself to avert the calamity".

As the present chapter deals with India's policy on chemical and biological warfare, it is worthwhile to consider various aspects of general policy of India too.

The chapter, therefore, has two parts:

i. General Policy.

ii. Policy on chemical and biological warfare.

i. GENERAL POLICY :

In 1947, when India emerged as a free, sovereign, democratic and independent country, it became imperative for its leaders to evolve a policy which not only kept it away from power blocs but also ensured its independence and sovereignty. Pt.Nehru, the first Prime-Minister of India, realized that freedom brought a tremendous burden of responsibility and the people of India had to shoulder it to play an important role in the world affairs.

The policy of India, a newly independent nation, did not emerge over night. Pt. Nehru, with general directions clear in his mind, set about building up the foreign-policy of India brick by brick, in the process discarding the generalizations which had taken the place of rigorous thought.[3] With his powerful vision and foresight, Pt.Nehru could easily visualize the vital part, India had to play, not only within her own vast boundaries but in the world, as she had done in the past before being dominated by muslims.

One of the major questions of the post independence

era was the readjustment of relations between Asia and Europe and India had to play a vital role in it. India became the meeting ground for various trends and forces between East and West.[4] In the past, especially by virtue of her economic and political domination, the west ignored Asia. But the attainment of freedom by India and other countries of Asia, the circumstances changed and India had to be viewed in a new perspective.

On closer analysis, it became apparent that there was a vast difference between the approaches of Europe and Asia. India was quite alive to the situation and was struggling hard against any possible involvement of her or any other country of Asia in the wake of conflicts in Europe. Although under prevailing global situations, it was not possible for any country to remain apart when there was major conflagration, her effort was to direct the national thinking towards avoiding such conflict and entanglement in it.[5]

The Indian security concept, while attempting to find-out effective ways of laying the foundation for stable peace, has been consistently based on the assumption that security is something concerning each and all. It requires purposeful action by all states, NBC and non-NBC, big and small, involved in military alliances and neutral and non-

aligned. Today, as never before, it is imperative to show political will in order to bring the world back to peaceful development, to limit the arms race and expand international co-operation.

Howsoever complicated the world situation may be, there is no theoretical insuperability of this situation, or fatal inevitability of the catastrophe. It is in this context that an ever stronger and more insistent voice is heard from the non-alignment movement against the policy of confrontation and for the solution of current global problems, the main of them being aversion of nuclear, biological and chemical war and curbing the arms race.[6]

Today the non-alignment movement envelops two-third of humanity. This movement originated from the common desire of newly independent countries to survive politically and develop economically in an atmosphere of international peace. War, cold or hot will certainly hamper and halt the growth or development of economically poor nations. It is impossible to eradicate poverty and unemployment without world peace. The policy of non-alignment does not imply neutrality in international relations. It does not certainly mean "sitting on fence" or isolationism. It is on the other hand, a positive, active and constructive policy seeking to lead to collective security which can really be ensured.[7]

India right from the days of Pt.Nehru has been wedded to the policy of non-alignment. The present Prime-Minister Mr. V.N.P. Singh is a great promoter of this movement. India's determination to pursue this policy and her consistent efforts to enlarge the area of peace reached the climax when she proclaimed the principles of co-existence in 1954. As Pt. Nehru said "The alternative to war, hot or cold, was peaceful co-existence". Non-alignment and peaceful co-existence are positive dynamic concepts.[8]

The concept gained world wide recognition when it found a place in the Sino-Indian agreement on 29 April,1954. The agreement embodied in its preamble the five principles, which later came to be known as "Panchsheel". Panchsheel points the way. Will the world take to it or be destroyed? As Pt.Nehru said, in the final analysis, the only alternative to peaceful co-existence is violent mutual destruction.

Pt. Nehru was a great exponent of Gandhian principles. He worked for framing permanent structure of national policy, the aim of which was to bring peace and security to the nation as well as to the whole world. This is the fundamental feature of the Indian policy that comes down from Pt. Nehru to Mr. V.N.P. Singh with strong and consistent support from other Prime Ministers of India, Mr. Lal Bahadur Shastri,

Mrs. Indira Gandhi and Mr. Rajiv Gandhi.

It is clear that the mile stones of India's policy since independence are the non-alignment, the panchsheel agreement of 1954, Tashkent declaration of 1966, Indo-Soviet treaty 1971, Shimla pact, Indo-Bangladesh treaty 1972, Indo-US agreement 1974 and Indo-Soviet declaration 1986. In fact, eversince India became independent, its policy has pursued the goal of general and complete disarmament.[9]

India believes that[10], there is a close relationship between disarmament and development. Therefore, there is an urgent need to change the attitude of the nations from a 'destructive' to a 'productive' use of the resources released as a result of the implementation of the disarmament measures, to use these resources for the economic and social development of all the nations. It would contribute to bridging the economic gap between the developed and the developing countries. This change of attitude and its consequential realization would accelerate the process of disarmament negotiation.

The horror of war and destructive capability of modern dreaded weapons made the people of the world think in terms of disarmament. The Govt.of India also adopted a

well defined and systematic policy towards disarmament and attached the highest importance to it. By making the Gandhian ethics of purity of means and non-violence as a corner stone of the disarmament policy, India sought to project the disarmament problem as a moral one.

As the experience of many years has shown, a decisive turn towards disarmament and the signing of concrete agreements on limiting the arms race will not come of themselves. It requires massive and combined efforts by all who are aware of the danger implicit in the continued arms race. The main thing today is to move from disarmament negotiation to concrete steps signifying the begining of disarmament. Nothing but this will meet the aspirations of the peoples who want lasting peace, who emphatically denounce the actions designed to increase the threat of another world-war, and openly condemn the arms race.

In the disarmament negotiations, India's role has been in conformity with the principles of non-alignment. Its role was limited to narrowing down the differences between the United States and Soviet Union. India's support for collateral measures in the field of disarmament was conditioned. It did not want the collateral measures to be conceived in isolation and given preference over the

ultimate goal of general and complete disarmament. It called for the elimination of the war-making capacity of all the nations on the earth.

In India's view, war, and defence against war, and the methodology of defence are dangerous and complicated questions. Peace is the most crucial issue of present time, not only for India but also for human race. India, therefore, intends to pursue its policy for peace, in the knowledge that success will be won through small and careful steps and not through miracles, with passionate concentration on what is possible, and an abiding healthy scepticism about some of the prognoses and propositions being offered these days.

ii. POLICY ON CHEMICAL AND BIOLOGICAL WARFARE :

Chemical and biological warfare is fraught with dangerous consequences. It can eliminate the very existence of mankind. It is a matter of concern for all nations how to do away with such weapons of war as threat into wipeaway every living being on earth. India which believes in Gandhian ethics of non-violence and Nehru's policy of non-alignment and peaceful co-existence, is more concerned than any other nation to take steps to outlaw such weapons of war, and her policy envisages not only the elimination of those weapons that can cause mass destruction but

disarmament in toto. India has, therefore, pleaded for gradual reduction and ultimate elimination of conventional weapons. Her concern about chemical and biological weapons is greater and she wants that the world be completely free from their threat. She is, therefore, in favour of complete elimination of this category of weapons.[11]

The advancement of science and technology in the past few decades has given a boost to the development of highly potential Chemical and biological weapons which are capable of causing casualties on a far greater scale than those caused by conventional weapons. The discovery of highly toxic compounds has brought humanity under the threat of total elimination. There are nerve agents which if used, could poison the nervous system and disrupt vital body functions[11A]; blister agents which could burn and blister the skin within hours after exposure; chocking agents which could bring about death by injuring the lungs; blood agents which could cause death by interfering with the utilization of oxygen by the tissues.[11B] The disaster that this type of weapons are capable of causing makes every nation, may every man shudder. India voiced her concern that once the door was opened to "this kind of warfare, escalation would in all likelihood occur, and no one could say where the process would end".[12]

The very existence of chemical and biological weapons has contributed a lot to mounting international tension. International community is simply horrified to imagin the uncontrollable and unpredictable injurious effects of such weapons. India, therefore, expressed her full support to the prohibition of the use of these weapons of mass destruction. India wanted strict observance of the principles and objectives of the Geneva protocol by all states.[13]

Prohibition 'to use' can not solve the problem unless the development, production and stockpiling of all chemical and biological warfare agents is stopped and their gradual but complete elimination from the arsenal of weapons is achieved.[14] Chances of peace would brighten significantly if chemical and biological agents are gradually put to an end and ultimately completely eliminated.

During the discussion on the question of chemical and bacteriological weapons, a controversy arose regarding the distinction between tear gases and poisonous gases or lethal and non-lethal chemical agents. India made it clear that the prohibition contained in Geneva protocol applies to all biological warfare agents, including tear gases and other harassing agents which now exist or which may be

developed in future. India is not in favour of making any distinction between chemical and biological weapons, she does not want to give a separate and preferential treatment to the biological weapons on the ground that they are more devastating than chemical weapons and therefore should be eliminated first. India pointed out that both are the weapons of mass destruction. Azim Hussain, insisted that there is no difference between the two categories of weapons. He supported his contention by quoting the report of the secretary general: All biological processes depend upon chemical or physico-chemical reactions and what may be regarded today as a biological agent could tomorrow be treated as a chemical one.[15]

Both types of weapons had been jointly dealt with in international agreements since 1925. The United Nations General Assembly in its resolution 2603 A (XXIV) deals with both types of weapons together. It declares that the use in international armed conflicts of :

(a) any chemical agents of warfare- chemical substances, whether gaseous, liquid or solid, which might be employed because of their direct toxic effects on man, animals or plants,

(b) any biological agents of warfare- living organism, whatever their nature, or effective material derived

from them-which are intended to cause disease or death in man, animals or plants, and which depend for their effect on their ability to multiply in the person, animal or plant attacked, is contrary to the generally recognized rules of international law. India has been against giving a separate treatment to biological weapons. If only biological weapons are banned, it can boost chemical weapons race[16] and pose the threat of most heinous disasters. India attaching great importance to the Geneva protocol declared that separate treatment of biological and chemical weapons would weaken the protocol and it would be difficult to justify to world opinion why biological weapons, which have never been used so far, should be dealt with first and chemical weapons, which have been used several times with disastrous effects, should be dealt with later.[17]

Moreover the world opinion could become shaky and prefer to give priority to biological weapons in the matter of disarmament and postpone consideration of banning chemical weapons on the pretext of this priority. Hence India always stressed that the problem of chemical and biological weapons should be tackled simultaneously and jointly as both are fraught with disastrous consequences.

India stands firmly for disarmament of both types of weapons simultaneously. She believes that it is not an unnecessary preoccupation or a minor procedural matter to consider them separately.[18] Delinking the two types of weapons would mean a fundamental departure from the accepted policy of dealing with both types jointly, and instead of solving the problem it would further complicate it. An agreement reached in respect of one category of weapons would only mean continuance of discussions on the other category and arms race for that category. Hence for the purpose of an agreement, India stands for treating both biological and chemical weapons together and does not like the idea of eliminating only biological weapons from the arsenals without touching chemical ones.

The problem of elimination of the two categories of weapons was by no means easy. The United States and United Kingdom were ready to accept immediate and total elimination of biological weapons from their arsenals on the ground that these weapons were more devastating and had long term ecological effects. The elimination of these weapons was more urgent and therefore required a priority treatment. The chemical weapons, on the other hand, could affect only a small area and were capable of being used with precision, so any discussion about their elimination could be postponed to a later date. If both were tackled

jointly there would be no progress in the matter.

Further they both realized that biological weapons are not reliable and are incapable of destroying tanks, planes, and artillery etc.so they are of no use for the purpose of deterrence or retaliation. Hence the United States did not consider it worth while to develop biological weapons further and stockpile them. A similar view was also adopted by the United Kingdom. Both of them expected that their unilateral decision should be followed by other states and sealed by a universal international agreement. The convention on the prohibition of development, production and stockpiling of bacteriological and toxin weapons and on their destruction was, therefore, concluded without considering the prohibition of chemical weapons.

While welcoming the happy developments in respect of biological weapons, India posed a question to the super powers: If biological weapons are of such little effective military use and so dangerous for a country itself to use that they have been unilaterally given up by important countries possessing or capable of possessing them, what is the urgency for concluding an international agreement in regard to biological weapons without waiting for an agreement on chemical weapons.[19]

Any how, India supported this separate convention

on biological weapons on the ground of commitment by the parties to the convention to work actively for concluding an agreement on the elimination of chemical weapons. India thought that this would preserve the link between the two categories of weapons. Although she reiterated time and again her stand for taking up the matter of biological and chemical weapons simultaneously, yet her supporting the separate convention and ultimately accepting and signing it was in line with her policy of giving encouragement to collateral and confidence-building measures in the field of disarmament. She stated that a begining in eliminating biological weapons would culminate ultimately in the elimination of chemical weapons. Thus the link between these two categories of weapons would not break.

But the problem of eliminating chemical weapons is complex. Chemicals are important for national security and their use is envisaged on an extensive scale in war. In the first world war about one lakh military personnel were killed by poison and about twelve lakh other casualties were reported by the end of that international holocaust.[20] This is enough to demonstrate the utility of chemical weapons in war. Therefore, various nations were reluctant to give up this capability at the risk of their own security. It is possible only when all possible opponents give up chemical weapons and stop developing them. Such

assurance would be difficult to achieve even with extensive inspection. How can the absence of chemical weapons be guaranteed? The problem is directly linked with production of chemical substances for peaceful uses. The two power blocs want a fullproof device to be fully confident of the non-existence of these weapons with the other block. So long as a device acceptable to both the power blocs is not forthcoming, both are reluctant to give up such weapons. So long as suspicion exists, international control would not work.

India, adhering to her policy of disarmament and abolition of all means of mass destruction, remained worried over the issue of reaching an agreement on the elimination of chemical weapons. She suggested an on-site-inspection of the stockpiles of either side by the two power blocs. The two supermost powers could determine the extent, nature and frequency of inspection they deemed necessary. Inspection by challenge or other such methods could be agreed upon. A verification could be based on a combination of national and international measures. This could provide an acceptable system capable of ensuring effective implementation of any prohibition of chemical weapons.[21] But the process was thought to be too extensive and difficult and no-body was sure how long it would take to formulate new prohibitions on the possession of chemical weapons. Thus there were a

numbers of difficulties in reaching an agreement on chemical weapons and the position remained static ever after the biological weapons convention. Many technical as well as political issues involved in the matter proved a stumbling bloc and a deadlock in the matter continued.

The difficulties in the way of reaching an agreement on chemical weapons were too many. Discussions regarding a ban on chemical warfare in the committees on chemical disarmament remained confired to the question of control and verification method and ended without reaching a conclusion. In the year 1976, the United States and the Soviet Union agreed to start bilateral negotiations for reaching an agreement on effective measures for the prohibition of the development, production and stockpiling ofall chemical weapons and their destruction. The United Nations General Assembly in its special session on disarmament in 1978 also emphasized the early conclusion of a convention banning chemical weapons for which negotiations had been going on for several years. As a result of the anxiety expressed by the General Assembly and the urge made by a number of members on the committee on disarmament, the super powers reported in July 1979 about the progress in their bilateral talks.[22] They recommended that the parties to the convention would not develop, produce, acquire, possess or retain any means of chemical warfare under any circumstances and

would not transfer the means of chemical warfare to anyone directly or indirectly and would not encourage any state to carry out prohibited activities and would destroy the stocks of means of chemical warfare with in ten years and means of production with in eight years and that the parties should be subject to adequate verification based on a combination of national and international means.[23] Above all, they declared that negotiations were continuing on several issues relating to the scope of prohibition.

It appears from the joint report that the differences between the United States and Soviet Union in respect of chemical weapons have considerably narrowed down. Although the negotiations were not completely successful yet they have paved the way for further consideration and understanding of the issues involved in and associated with the chemical weapons- political, military, legal and technical. It can easily be felt that a ground has been prepared for debate on the question of concluding an agreement. But the complicated problems of capabilities, scope and verification are inter-related and they provide endless opportunities to the states to delay and avoid any agreement. Concrete results can be achieved by a strong will on the part of the government to overcome the intricacies involved in the elimination of these dreadful weapons.

India took a positive stand and her policy of total elimination of all sorts of weapons of mass destruction remains unchanged. India's representatives in their statements on different occasions always pleaded for the Geneva protocol and even after biological warfare convention never missed an opportunity to speak for the abolition of chemical weapons. India's views and policy are fully expressed in utterances made by her representatives from time to time. Some of them which reflect India's policy on chemical and biological warfare, are quoted below.

Vijayalaxmi Pandit in the United Nations General Assembly on September 25, 1948 said:[24]

> It was obvious that the threat of war could not be banished from the world unless the present race for armaments was abandoned. As has been emphasized by the Secretary General, almost as important as the elimination of atomic weapons was the outlawing of biological and chemical warfare, which was said to have been perfected to such an extent as to threaten the very existence of mankind. The General Assembly must devote serious attention to these matters.

Ambassador Hussain in Aug,1968 supporting the Geneva protocol of 1925 said:[25]

> I reiterate the full support of the Government of India for total prohibition of the use of these weapons of mass destruction and the need for strict observance by all states of the principles and objectives of the Geneva protocol of 1925 and accession thereto of those states which had not adhered.

Ambassador Banerjee speaking in the first committee, on November 29, 1971 laid stress on the importance of Geneva protocol, and said:[26]

"It should be safeguarded, and nothing should be done which might either adversely affect the protocol or cause doubts on its continuing validity."

Addressing the Committee on chemical disarmament on 23rd March,1972, he said:[27]

> The question of elimination of chemical weapons is to be given high priority.

To sum up, India, in accordance with her ethics of non-violence and her ideal of peaceful co-existence, stands not only for total abolition of all weapons of mass-destruction but also for reduction in conventional weapons. India has always pleaded and worked to create an atmosphere to induce the power blocs to come nearer to each other, and

to build and create confidence between them. She wants that conflicts should be settled through negotiations and not through war; only then could an era of peace emerge and humanity heave a sigh of relief from tension and coercion. By and large India shapes her policy to achieve this goal.

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CHAPTER - VII

C O N C L U S I O N

The human-world has come today to a point of total annihilation to its own manoeuvre and thinking. But the general awareness of the people about the impending catastrophe is so fickle, mute and passive that it looks all the more surprising and shocking. It is queer to note that though nobody is unaware of what is going on over the international political horizon, a solid and pragmated reaction is not forthcoming. Because of that, in the disarmament negotiation of the post-war period, every other consideration such as national security, territory integrity, safeguard of ideology etc.are more predominent in the minds of world-leaders than the realisation of the expected loss of humanity or human dignity on this earth. As a result, man has become a tool of his own tools and is trying to discover inner harmony in the jungle of conflicting ideologies safeguarded by competing armament race that our world has become.

On the other hand, it is well known fact that the shape and nature of war has undergone a basic change. In no way, it is a traditional confrontation today. The overall picture of the war has been transformed into total war. Now a days war is not confining itself only to territorial boundaries and army installations but also extending to school, universities, hospitals and economic establishments.

War may break in any part of the world, no nation, however remote and far-off, is left unexposed to the effect of war directly and indirectly. It is an open secret that during war, every nation does employ all its resources against enemy with-out caring for moral and human-obligations.

To make the situation even worse, about thirty nations of the world have already developed the technique of chemical and biological weapons and enhanced their striking capability with huge stockpiles of these warheads. More-over in corridors of power in both washington and Moscow, the unthinkable is being planned and executed to the last detail. The deployment of Pershing-2, cruise and Soviet SS-19 (ICBM) has made Europeans particularly aware of their vulnerability. But known only to a few, there lies dormant on European soil vast stocks of chemical and biological warheads whose use opens up even greater vistas of horror and which would unhesitatingly be used in the event of war.

In such a grim international situation, no country is to be complacent of its security and defence. Unity and integrity of a nation can not be compromised at any cost. It is especially true with India, maintaining a long border with neighbours not always unhostile. Under such circumstances, the policy-makers of India with respect to these

weapons as well as in general have to develop a pausible and effective defence plan, taking into consideration the principles and thought underlying policies adopted by our country from time to time. But one can not make a policy decision in isolation without evaluating the defence environment in the neighbourhood and over the global set-up.

Adjoining our borders, stretching the boundaries of Nepal, Bangla Desh, Sri Lanka and Pakistan which are regarded as our immediate neighbours. Among them no country is said to be very close and friendly with India. Nepal with long cordial relations with us, has recently developed a hostile posture importing arms and ammunition from China, pronouncing adverse comments and making baseless allegations against the thought and policy of our Government. Bangla Desh born after genial hatching of India, is constantly harping against her, propagating Islamic fraternity with intensions always destructive for our country. Sri Lanka, although signed an agreement under which Indian peace keeping force (IPKF) landed on their soil and helped them in maintaining peace, keeps on straining the relation with us, inspite of India's best effort for a friendly tie. Last but not the least, Pakistan which was originally created by vested interests, not very surprising, if she remains always hostile to India by offering training facility to

the terrorists of Punjab and Kashmir, supplying arms to them and promoting secession in these states.

Pakistan herself may not pose a grave danger, but its alliance with Arab-world specially with Libya and Saudi Arabia under the pretext of saving Islam, presents a disastrous picture. None can, therefore, disagree that Pakistan can even procure chemical weapons, which are reported to have been used in the protracted Iran-Iraq war.

India has always held that the weapons are meant not for annexing the territories of the other countries but for the defence of a country. So she has pleaded and worked to create an understanding and to induce the power blocs to come nearer to one another. She has always struggled to build and create mutual confidence. She wants that conflicts should be settled through negotiation and not though war. Only then could an era of peace emerge and humanity heave a sigh of relief. India has demonstrated this policy in the context of Pakistan. Our Prime-Minister Mr. V.P. Singh has laid stress on the Shimla Pact and explained that war is looming large on our frontiers for which Pakistan is totally responsible. And it is for Pakistan to decide whether she wants to resolve the Kashmir issue either by war or through peace negotiation with bilateral-talk.

On shifting the focus from our neighbourhood, we catch the glimpse of the blazing land of China whose expansionistic manoeuvring always endeavours to engulf as much chunk of our land as possible. On the otherside, super powers rivalry and their presence in Indian ocean compels India to remain over cautious and alive to the ominous clouds gathering over our well-guarded horizon. The dilution of communism all over the world including Soviet Union and the prospect of reunified Germany joining the NATO, makes further complications for the peace and security.

So when there is an atmosphere of mistrust and unfriendliness among our neighbouring nations regarding their relations with us, we have got to revise our policy and reconsider what its nature be. It is high time when we may have to shed off our old stands and be pragmatic in our approach. Prevailing political upheavels on the international horizon are reasonably compelling us to be free from illusions and take some healthy initiative to defuse the tensions of the globe particularly of Asia.

The present study deals with various aspects of chemical and biological warfare. In the previous chapters an account of what has been done and accomplished in the world, with respect to chemical and biological weapons,

has been discussed with a detail analysis of what is said to be its history, development, classification, effects, application, prevention and defence. This is fundamental investigation providing valuable informations on various aspects of these warheads. This preliminary knowledge is essential for those who are entrusted with making policy decision. To further assistance a brief study on the policy of India and on the international policy has also been included.

India's stand is based on the policy of non-alignment, peaceful co-existence and Gandhian ethics of purity and non-violence, the aim of which is to bring peace and security to the nation as well as the whole world. This is the fundamental feature of the Indian policy that comes down from Pt. Nehru to Mr. V.P. Singh with strong and consistent support of the other Prime Ministers of India. It is this policy that made India to work for disarmament after winning the approval and co-operation of the most of the countries of the world. With their sincere efforts a number of protocols and agreements were signed from time to time, but they were never proved to be effective means of preventing arms race, among those who have acquired advanced technology in the field of lethal arms and weapons of mass-destruction. The major flaw behind these agreements is the absence of a power or authority that can control and

compel the obstinate nations to abide by the clause of agreements formulated therein.

In fact, the policy of India is an ideal and moralistic policy based on human and spiritual values. Such a policy has a capacity of wide and universal appeal but the world today is something different from what the Indian idealism is to be. Today not only the national security and sovereignity is being constantly threatened but also the international environment of war is not being evaporated and removed. It requires a practical and pragmated approach towards the problem of disarmament and total ban on the use of chemical and biological weapons. Such a fundamental thinking is seen in the words of Mrs.Indira Gandhi when she speaks that we have of course dealt and created nuclear energy for peaceful and constructive purposes. But it can also be considered in the context of defence, if the needs warrant it. The policy makers of India have to ponder over this approach of ex-Prime Minister in the context of chemical and biological weapons to accept a revised stand without any reservations.

From the very beginning India has always been opposed to the use of inhuman weapons like chemical and biological ones. The Geneva Protocol has laid emphasis on the total elimination of these warheads. Since India has

absolute trust in the protocol, naturally she neither possesses these weapons nor intends to manufacture them, but incase the news of Pakistan's importing these weapons and gas-maks is true, India will definitely get suspicious. And India has definitely got suspicious. A new way for a new thinking has been paved out.

Today the scene of world politics is not pleasant. India must understand that the moral and human values are more important to India than other selfish nations. Today to think of peace alone is not sufficient. We have got to be so much resourceful and powerful that we may defend it.

Under these circumstances, it is quite imperative for the policy-makers of India to revise their stand accepting a modification of allowing extensive research on the development, application, impact, prevention and defensive techniques of chemical and biological weapons. It will, on one hand, result in tremendous break through in the field of science, Medical Science and defence. On the other hand, it will boost up the morale of army as well as civilians. There is no denying the fact that the research of the kind would enable India to prevail over other countries in the disarmament negotiations regarding these weapons. Inspite of having its knowledge, it is very much commendable not to use a particular weapon.

Such an investigation never aims at acquiring and stockpiling these warheads but until the fundamentals are known, the means of prevention and defence can not be developed. This compulsion for our nation has prompted me to work on these warheads with a sincere endeavour to throw as much light on them as possible, within the perview of an academic research.

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